A Text Book
of
X-Ray Technique

INSTRUCTION BOOK

Embodying the

Use of the Modern Dental X-Ray

in

Intra-Oral ~ Stereoscopic

Extra-Oral ~ Sinus ~

Profile and Extremity
Radiography

1932

Ritter Dental Manufacturing Company, Inc.
Rochester, New York

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The Ritter X-Ray Machine harmonizes perfectly with the other items of Ritter Equipment

A Complete Treatise on X-Ray Technique and Instructions for Taking Radiographs with the Ritter Dental X-Ray Machine

THE radiograph is one of the greatest aids in diagnosis at our disposal. To be an *aid*, however, the radiograph must be an accurate and authentic reproduction of existing conditions, taken at the proper angle, properly exposed and properly developed.

The radiographic technique should be of a standardized character, with the radiographs of each area made with a definite application of all factors. By eliminating all variable factors each set of radiographs can be made with a uniform degree of detail, so that any feature indicating a deviation from the normal condition may be readily distinguished. The following instructions for making radiographs with the Ritter X-Ray Machine have proved very satisfactory for obtaining the most practical results as referred to above.

To obtain dental radiographs that represent true conditions, certain rules must be observed, and the directions that follow, together with the illustrations, will enable anyone who has never had any previous experience to learn how these radiographs should be taken.

The accompanying figures give an excellent idea of the various positions to be used in taking intra-oral radiographs.

Position of Machine at Chair

The four illustrations, Figures 2, 3, 4 and 5 show the most desirable positions for the Ritter X-Ray Machine in relation to the chair.

When used in the operating room, the machine may be placed with either the front or the side of the machine facing the window, the object being to place it in a position so that it is out of the way of both the operator and his assistant when not in use. The machine may be placed either to the left or to the right of the rear of the chair as long as the distances indicated are observed.

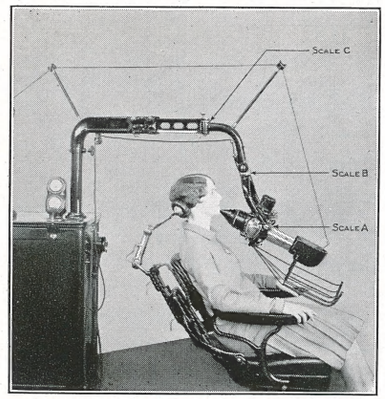


Figure 1

The correct position of the pivotal point of arm at Scale C is a few inches in front of the head-rest pads as shown in Figure 1, and in a plane directly over the center between the two head-rest pads when viewing it from the front of chair. This position enables the complete rotation of the Ritter Tube-holder around the face of the patient for taking intra-oral radiographs. A full-mouth examination may be made with only little change in the position of the pivotal point.

Position of X-Ray Machine in Operating Room Showing Proper Relation To Chair

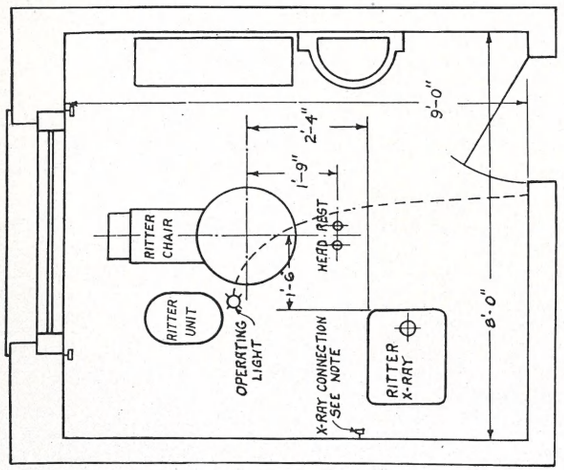


Figure 2—Wide Operating Room

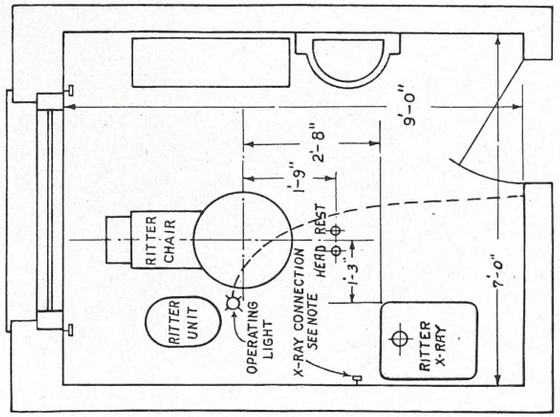


Figure 3—Narrow Operating Room

When using X-ray machine, recline the back of the chair to an operating position and adjust the headrest so it holds the patient's head firmly and in an erect position, with the sagittal plane of the head vertical and with the line of the crowns of the teeth horizontal.

Note: Three-way receptacle supplied with X-ray. To be mounted in type "B" "Gem" box 2¾ inches deep and about 18 inches from the floor. Connections to receptacle composed of two No. 10 wires for supply current. Third wire to be grounded to water pipe and connected with the terminal on plug stamped "Ground." Grounding to conduit not sufficient.

Position of X-Ray Machine in Operating Room or Small X-Ray Room Showing Proper Relation To Chair

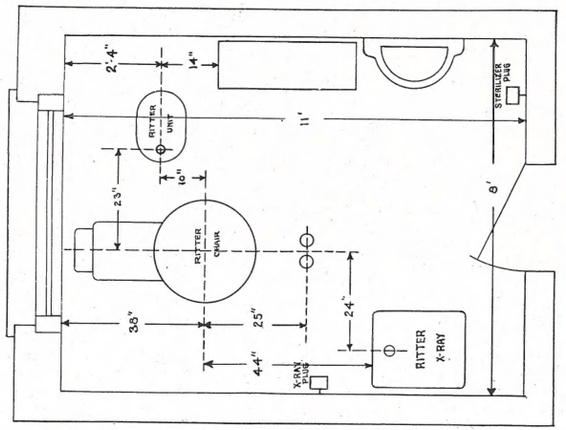


Figure 4—Operating Room with Unit installed at Right of Chair

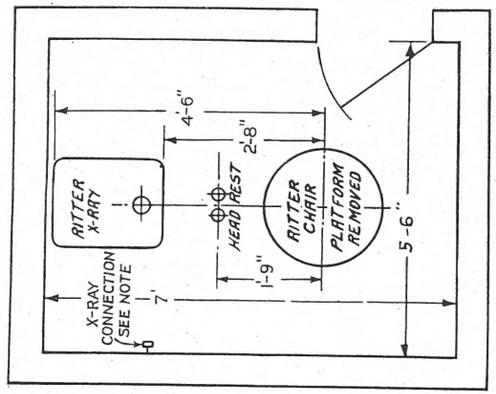


Figure 5—Small X-ray room using Ritter Chair with platform removed

NOTE: Three-way receptacle supplied with X-ray. To be mounted in type "B" "Gem" box 2¾ inches deep and about 18 inches from the floor. Connections to receptacle composed of two No. 10 wires for supply current. Third wire to be grounded to water pipe and connected with the terminal on plug stamped "Ground." Grounding to conduit not sufficient.

If it is necessary to locate the machine in front of the chair seat, then place it either a little to the right or left of the foot platform. The angles given in the Ritter X-Ray Exposure Table should then be read on Scale B instead of Scale A.

Intra-Oral Radiographs

In making a full-mouth examination, at least fourteen films are necessary to completely examine the mouth (see Figure 6).

In cases where the teeth are in mal-position it is always advisable to use 14 films. In this way the teeth are produced in proper focus and duplications of many teeth are made at slightly different angles, all of which is valuable in making their interpretation less difficult. To save time the radiographs should be taken in the sequence shown below. This makes it unnecessary to set the X-ray tube at the same angle more than once while taking the fourteen radiographs.

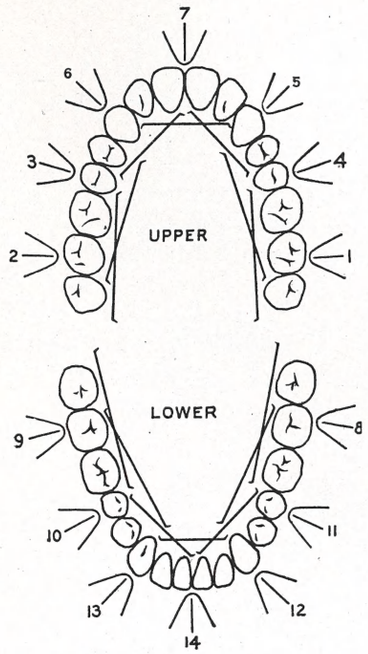


Figure 6

Figure 6 indicates the position of the films and also the horizontal angles for both upper and lower jaws, when making a 14 film examination.

Upper Jaw	*Scale "A" (Lower Part)*	Lower Jaw	*Scale "A" (Upper Part)*
1. Left molars 1st, 2nd & 3rd	25°-30°	8. Left molars 1st, 2nd & 3rd	0°-5°
2. Right molars 1st, 2nd & 3rd	25°-30°	9. Right molars 1st, 2nd & 3rd	0°-5°
3. Right bicuspids & 1st molar	35°-40°	10. Right bicuspids & 1st molar	10°
4. Left bicuspids & 1st molar	35°-40°	11. Left bicuspids & 1st molar	10°
5. Left cuspid and lateral	45°-50°	12. Left cuspid and lateral	20°
6. Right cuspid and lateral	45°-50°	13. Right cuspid and lateral	20°
7. Right and left centrals	45°-50°	14. Right and left centrals	15°-20°

For the 8 posterior areas, the film is placed in the mouth with the long axis of the film horizontal, while in the 6 anterior areas it is placed vertically.

Ritter X-Ray Exposure Chart

(14 Film Technique)

TEETH	Angles Scale "A"	REGULAR Time in Seconds			RADIA-TIZED Time in Seconds			EXTRA-FAST Time in Seconds		
		Small Jaw	Med. Jaw	Large Jaw	Small Jaw	Med. Jaw	Large Jaw	Small Jaw	Med. Jaw	Large Jaw
Upper Molars	25-30	7	8	9	3½	4	4½	2	2¼	2½
Upper Bicuspids	35-40	3	4	5	2	2½	3	1	1¼	1½
Upper Cuspid and Lateral	45-50	4	5	6	2½	3	3½	1¼	1½	1¾
Upper Centrals	45-50	4	5	6	2½	3	3½	1¼	1½	1¾
Lower Molars	0-5	4	5	6	2½	3	3½	1¼	1½	1¾
Lower Bicuspids	10	3	4	5	2	2½	3	1	1¼	1½
Lower Cuspids	20	3	4	5	2	2½	3	1	1¼	1½
Lower Incisors	15-20	3	4	5	2	2¼	2½	1	1¼	1½
Place center of film directly behind tooth you want in center of radiograph.		When using "Regular" film, the above table shows proper exposures for a middle - aged person, classified according to size of jaw. (*Small, Medium, Large.*) For a young person subtract 1 second. For an elderly person add 1 second.			When using "Radia-Tized" film the above table shows proper exposures for a middle-aged person, classified according to size of jaw. (*Small, Medium, Large.*) For a young person subtract ¾ second. For an elderly person add ¾ second.			When using "Extra-Fast" film, the above table shows proper exposures for a middle-aged person, classified according to size of jaw. (*Small, Medium, Large.*) For a young person subtract ½ second. For an elderly person add ½ second.		

Angles shown on scale "A" are approximate angles of the tube for radiographing teeth in the average mouth when using the small wood block film holder or the digital method of film retention, and provide a latitude for abnormal mouths.

In a mouth where the vault is high use the lesser angles as charted.

In a mouth where the vault is low use the higher angles as charted.

The pointer of X-ray tube must be directed at the apices of the teeth to be radiographed. In edentulous or partially edentulous mouths the time of exposure recommended above should be approximately one-third less.

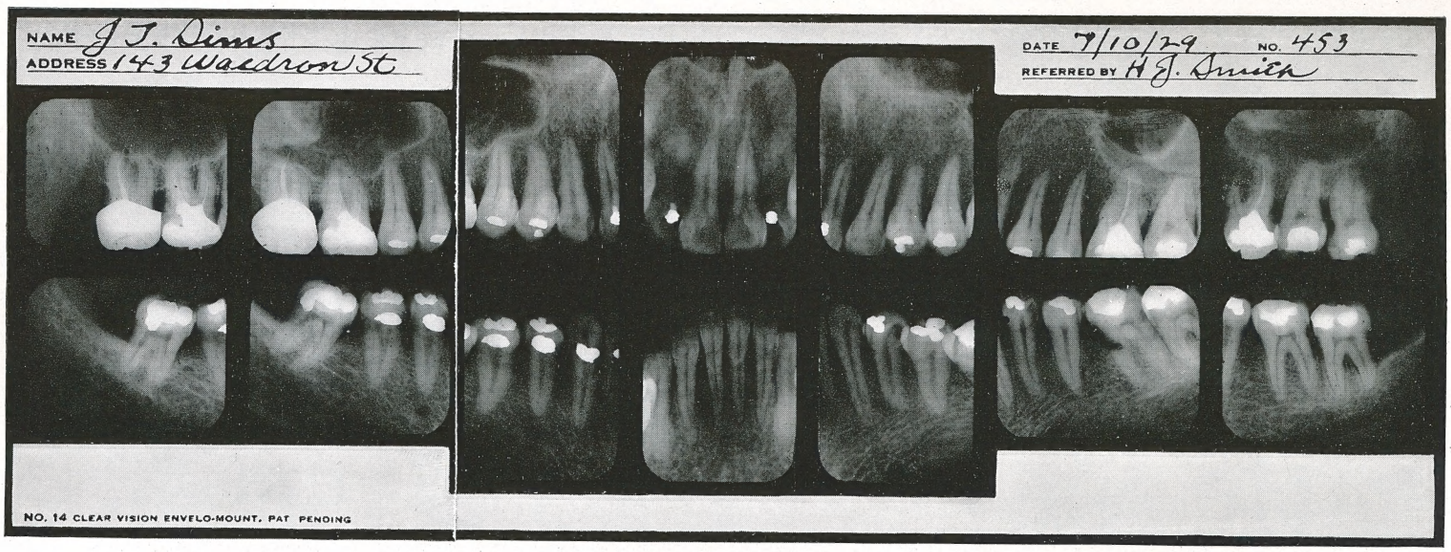


Figure 7

14 Window Full Mouth Film Mount

The ideal 14 window film mount has the six windows for anterior teeth in a vertical position, and it will be found that films can be easily adapted to the mouth in the anterior regions without excessive bending, if inserted according to the arrangement shown.

For the 8 posterior areas the film is placed in the mouth with the long axis of the film horizontal, while in the six anterior areas it is placed vertical.

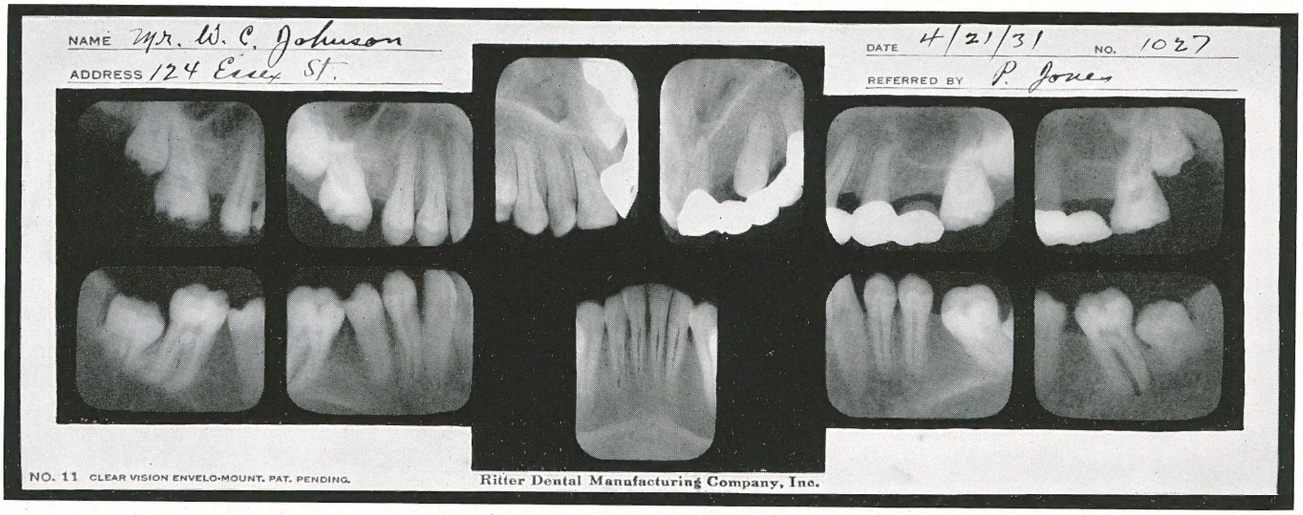


Figure 8

11 Window Full Mouth Film Mount

The ideal 11 window film mount has the three windows for anterior teeth in a vertical position, and it will be found that films can be easily adapted to the mouth in the anterior regions without excessive bending, if inserted according to the arrangement shown.

For the 8 posterior areas the film is placed in the mouth with the long axis of the film horizontal, while in the 3 anterior areas it is placed vertical.

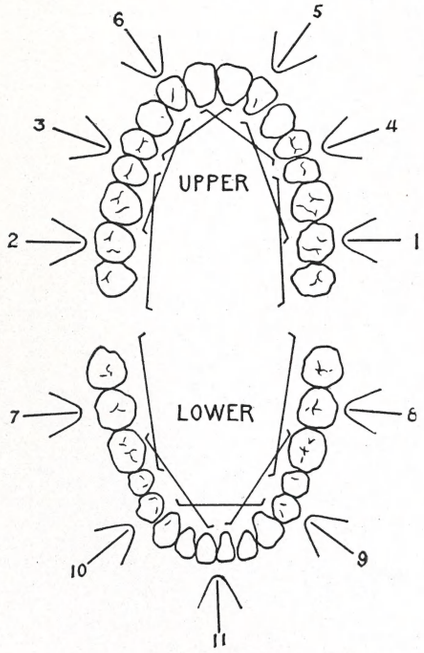


Figure 9

Figure 9 indicates the position of the films and also the horizontal angles for both upper and lower jaws, when making an 11 film examination.

Upper Jaw	Scale "A" (Lower Part)
1. Left Molars, 1st, 2nd & 3rd	25°–30°
2. Right Molars, 1st, 2nd & 3rd	25°–30°
3. Right Cuspid and Bicuspids	40°–45°
4. Left Cuspid and Bicuspids	40°–45°
5. Left Central and Lateral	45°–50°
6. Right Central and Lateral	45°–50°

Lower Jaw	Scale "A" (Upper Part)
7. Left Molars, 1st, 2nd & 3rd	0°–5°
8. Right Molars, 1st, 2nd & 3rd	0°–5°
9. Right Cuspid and Bicuspids	10°–15°
10. Left Cuspid and Bicuspids	10°–15°
11. Incisors.	15°–20°

For the 8 posterior areas the film is placed in the mouth with the long axis of the film horizontal, while in the 3 anteriors it is placed vertically.

Ritter X-Ray Exposure Chart

(11 Film Technique)

TEETH	Angles Scale "A"	REGULAR Time in Seconds			RADIA-TIZED Time in Seconds			EXTRA-FAST Time in seconds		
		Small Jaw	Med. Jaw	Large Jaw	Small Jaw	Med. Jaw	Large Jaw	Small Jaw	Med. Jaw	Large Jaw
Upper Molars	25°–30°	7	8	9	3½	4	4½	2	2¼	2½
Upper Cuspid and Bicuspids	40°–45°	3	4	5	2	2½	3	1	1¼	1½
Upper Central, Lateral and Cuspid	45°–50°	4	5	6	2½	3	3½	1¼	1½	1¾
Lower Molars	0°–5°	4	5	6	2½	3	3½	1¼	1½	1¾
Lower Cuspid and Bicuspids	10°–15°	3	4	5	2	2½	3	1	1¼	1½
Lower Incisors	15°–20°	3	4	5	2	2¼	2½	1	1¼	1½
Place center of film directly behind tooth you want in center of radiograph.		When using "Regular" film, the above table shows proper exposures for a middle - aged person, classified according to size of jaw. (*Small, Medium, Large.*) For a young person subtract 1 second. For an elderly person add 1 second.			When using "Radia-Tized" film the above table shows proper exposures for a middle-aged person, classified according to size of jaw. (*Small, Medium, Large.*) For a young person subtract ¾ second. For an elderly person add ¾ second.			When using "Extra-Fast" film, the above table shows proper exposures for a middle-aged person, classified according to size of jaw. (*Small, Medium, Large.*) For a young person subtract ½ second. For an elderly person add ½ second.		

Angles shown on scale "A" are approximate angles of the tube for radiographing teeth in the average mouth when using the small wood block film holder or the digital method of film retention, and provide a latitude for abnormal mouths.

In a mouth where the vault is high use the lesser angles as charted.

In a mouth where the vault is low use the higher angles as charted.

The pointer of X-ray tube must be directed at the apices of the teeth to be raidographed. In edentulous or partially edentulous mouths the time of exposure recommended above should be approximately one-third less.

Position Technique and Proper Angulation

VERTICAL ANGLE—Whenever it is necessary to direct the rays upon structures that lie at an angle with the plate or film, correct shadows will be obtained by adhering to the following rule: "Bisect the angle made by the plane of the object, and the plane of the film, and direct the rays so they will fall perpendicular to this bisecting plane." (See Figures on pages 16 and 17.)

Failure to adhere strictly to this rule is one of the most common causes of partial or complete failure in producing true shadow-graphic representations of the dental structures.

The importance of adhering strictly to this rule is graphically shown in Figures 10, 11 and 12, where a radiograph of an upper central incisor is shown. In Figure 10 the rays are passing in from too low a source, with the result that the image imposed upon the film is lengthened to the extent that the resulting radiograph is useless.

In Figure 11 the rays are coming from too high a source, the result being a shortened image. Such a radiograph has but little value and in many instances would prove very misleading.

In Figure 12 the rays are passing in at the correct angle, viz., they are directed perpendicularly to a bisecting plane midway between the film and the tooth. The result is a radiograph in which the images of the teeth desired are imposed upon the film in their correct proportions.

This technic is indicated for all teeth, although with the lower molar teeth we do not have quite the same difficulty to contend with, as the films can usually be placed in such a position that they lie parallel to the long axis of the teeth, and the rays can be directed in a perpendicular direction both to the plane of the teeth and the plane of the film.

Showing Correct and Incorrect Angle of Rays in taking Radiographs

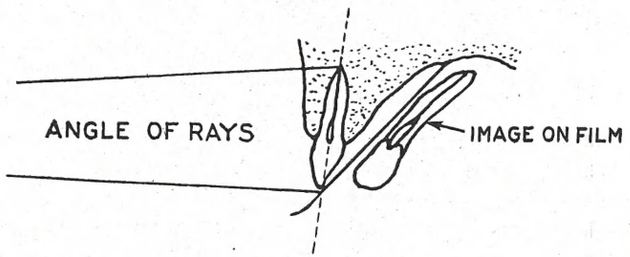


Figure 10

Showing rays passing in at too low an angle, the result being an elongated image on the film.

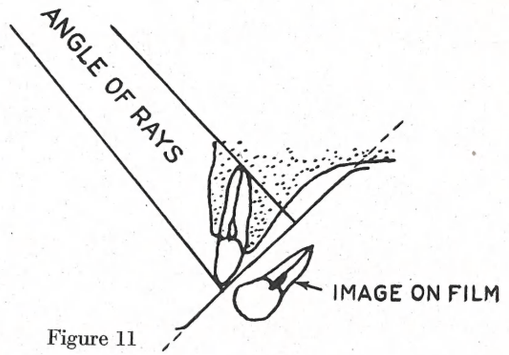


Figure 11

Showing rays passing in at too high an angle, the result being a foreshortened image of the film.

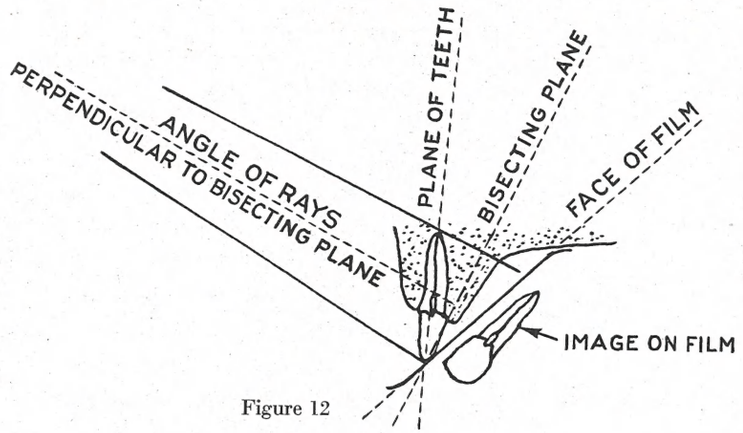


Figure 12

Showing rays passing in at the correct angle, that is, they are directed perpendicular to a plane that bisects the angle formed by the plane of the teeth desired and the face of the film. The result is a radiograph in which the image of the desired teeth is of correct proportions.

In summarizing, the operator should direct the X-rays at right angles to a line that bisects the angle formed by the plane of the film and the plane of the tooth, at a point opposite the apex of the tooth.

Knowing the difficulty in figuring out the plane of teeth, film, etc., and directing X-rays perpendicular to these imaginary lines, certain devices have been provided to obtain correct root length automatically. The Ritter machine is equipped with a calibrated scale (Scale A) to obtain correct root length.

The angles on the previous page will apply in the average case when using the small wood block film holder or the thumb and forefinger method of film retention and provide a latitude where it may be necessary to deviate slightly with certain individuals, by decreasing the angle where the vault is higher than usual, and increasing the angle slightly where the vault is lower.

Position of Patient

Since we are using a fixed system of angles, it is important to have the patient's head in a fixed position. When radiographing all upper teeth, the head of the patient must be so positioned in the headrest, that an imaginary line, drawn from the tragus of the ear to the ala of the nose, will be horizontal or parallel to the floor.

In radiographing the lower jaw, permit the head to be tilted slightly backward so the lower border of the mandible is parallel to the floor, when the mouth is partly open. The sagittal plane of the head should be vertical—the head should not be tilted one way or the other, but straight up and down. Figures 13 and 14 demonstrate the correct position of the patient's head.

Accuracy of Technique is Accomplished with Pointed Cone and Definite Landmarks of All Areas

UPPER MOLAR REGION—Pointer of cone touching face on line extending through apices of teeth (from the ala of the nose to the tragus of the ear), at a point directly below the corner of the eye. (Place film in the mouth in a horizontal position.)

UPPER BICUSPID REGION—Pointer of cone touching face on line extending through apices of teeth (from ala of nose to tragus of ear) at a point directly below the pupil of the eye. (Place film in the mouth in a horizontal position.)

UPPER CUSPID AND LATERAL REGION—Pointer of cone touching face on line extending through apices of teeth (from ala of nose to tragus of ear), directly at the ala of the nose. (Place film in the mouth in a vertical position.)

UPPER CENTRAL REGION—Pointer of cone touching tip of nose. (Place film in the mouth in a vertical position.)

LOWER MOLAR REGION—Pointer of cone touching face at lower border of mandible on line extending through apices of teeth, at a point

directly opposite second molar. (Place film in the mouth in a horizontal position.)

LOWER BICUSPID REGION—Pointer of cone touching face at lower border of mandible on line extending through apices of teeth, at a point midway between first and second bicuspids. (Place film in the mouth in a horizontal position.)

LOWER CUSPID REGION—Pointer of cone touching face at lower border of mandible on line extending through apices of teeth, directly at cuspid tooth. (Place film in the mouth in a vertical position.)

LOWER CENTRAL REGION—Pointer of cone touching chin on line extending through apices of teeth, directly between the two central incisors. (Place film in the mouth in a vertical position.)

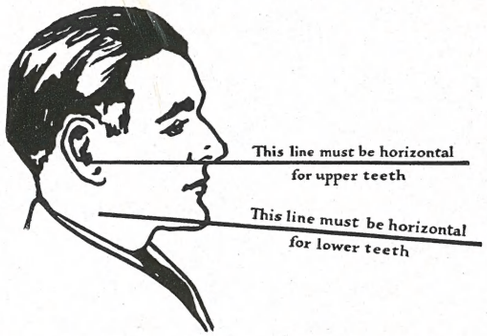


Figure 13

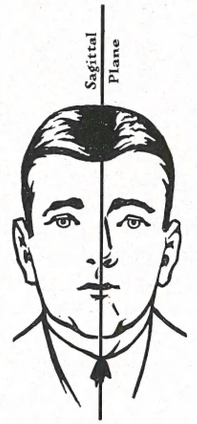


Figure 14

Routine Examination for Focal Infection

Both lines as illustrated above correspond to the occlusal plane of the teeth when the mouth is open, but pass directly through the apices of the teeth, and designate the entrance point for the central ray when positioning the point of the cone to the face. To successfully use the angles recommended in the Ritter X-Ray Exposure Table, the patient's head must be positioned so these lines are horizontal and the sagittal plane vertical, when the mouth is open, and the film in place. The headrest should be adjusted so it holds the head firmly, and the patient should be cautioned not to tilt the head to either side, otherwise it is impossible to get proper results.

HORIZONTAL ANGLE—No overlapping of Teeth—A good radiograph not only should show correct root length, but there should be no overlapping of teeth. The lamina dura and peridental membrane are the first structures to show a change from the normal, under pathological conditions, consequently it is important to show these structures in their proper position, by directing the X-rays straight through the teeth parallel to the mesial and distal surfaces, or in other words, parallel to the proximal surfaces. This will also produce a radiograph showing proper proximal contact, with a view of disclosing the presence of proximal carries. Figure 15-A shows a cut of proper proximal contact, while Figure 15-B that of overlapping which is incorrect.

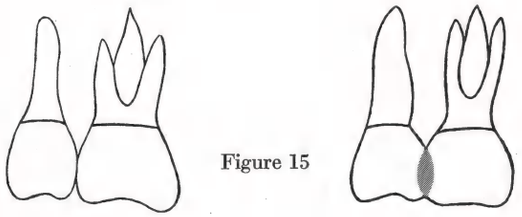


Figure 15

A
Proper proximal contact

B
Improper overlapping

The Ritter Exposure Chart gives the correct angles in a vertical plane when the head is properly positioned. To obtain the correct direction of the central ray in a horizontal plane, when making routine examination for foci of infection, direct the rays through the teeth parallel to the proximal surfaces, as illustrated in Figure 16-A.

Figure 16-B shows the wrong direction of rays where overlapping would result.

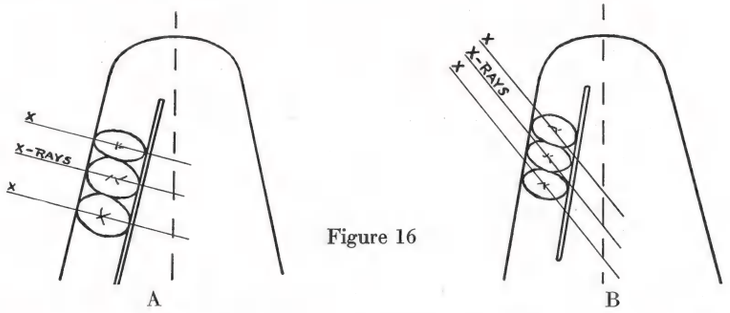


Figure 16

A B

It is important that the rays are not directed mesially or distally, otherwise the shadows will partly superimpose, destroying the clean-cut appearance of the film, and blotting out some of the structures necessary to accurate interpretation, and distorting the relations between apices and surrounding structure.

If the radiograph does not show the apices of the roots, it is because the film was not placed in the correct position in the mouth or the central rays were not directed properly.

Root Canal Examination

MULTI-ROOTED TEETH—The rules given previously to prevent overlapping of teeth in a radiograph are excellent and should be followed in the ordinary routine X-ray examination. In the case of root-canal work it frequently becomes necessary to deviate from this rule, by directing the rays slightly mesially or distally, but always maintaining the same vertical angle on Scale "A" as shown in the Ritter exposure chart. This method of angulation is in order for all multi-rooted teeth so as to prevent superimposition of roots under observation and treatment.

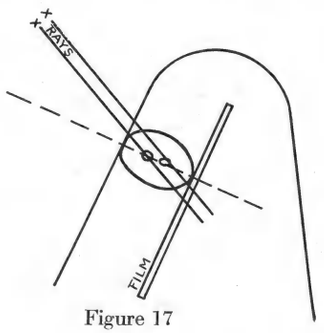


Figure 17

In upper bicuspids, if the rays are directed only in a direction parallel to the proximal surfaces, the buccal root will be cast upon the lingual root, producing a radiograph which is useless for examining root canal conditions. To be able to see both roots or canals in the upper first bicuspids clearly, direct the rays slightly mesiodistally at about 15° off the right angle as shown in Figure 17.

In radiographs of the upper molar teeth it is very rarely that all three roots can be seen clearly on one film because of superimposition, so for root canal work, radiographs should be taken both mesially and distally, or in other words, it is important, in order to have all the roots show plainly, to direct the rays at two or more angles in a horizontal plane, but always maintaining the same angles in a vertical plane, as shown in the Exposure Chart and on Scale A.

In Figure 18-A the slight mesial direction of rays will produce a distinct image of the disto-buccal roots. In Figure 18-B the slight distal direction of rays will produce a distinct image of the mesio-buccal roots.

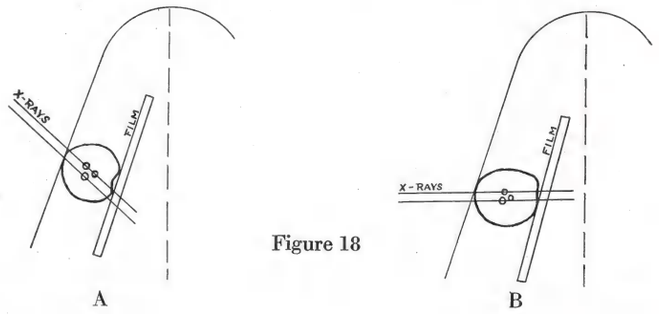


Figure 18

A B

In lower molars similar reasoning applies, and to prevent superimposition, direct the rays from the vertical angles recommended in the table and make the horizontal positions of the tube so that the central ray passes through the tooth perpendicular to the long axis of the tongue.

Figure 19 shows how all canals of lower molars can be clearly shown.

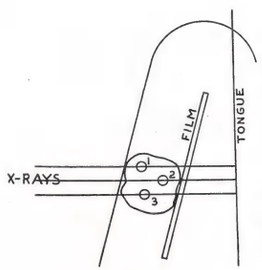


Figure 19

The Stereoscopic shift on the Ritter Machine lends itself admirably in following the practice suggested of taking radiographs of a tooth from two different positions of the tube, that is, taking one mesially and the other distally, but both at the same angle, as shown on Scale "A."

This often enables making a correct diagnosis when it is difficult to do so with only one radiograph.

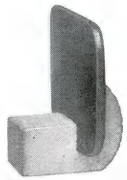
To carry out this idea make one radiograph from the extreme left side of the stereoscopic shift, and then without disturbing the adjustments, move the tube to the extreme right side of the shift, insert a new film, and make the second exposure.

DUPLICITY RADIOGRAPHS—It is possible to accurately duplicate radiographs at any subsequent sittings if the operator, when radiographing a tooth under treatment, will record the readings on Scale "A," "B" and "C." When these angles are again applied to the scales for a second exposure, the resulting radiograph will reveal accurately the progress of treatments.

It is essential to have the patient's head in the same position (explained on page 19) and the machine in the same relation to the chair for all subsequent exposures. Usually a mark can be made on the floor at two corners of the cabinet for properly locating the machine in relation to the chair.

Placing the Film in the Mouth

There are two methods of intra-oral technique employing either the small wooden bite block or the thumb and forefinger method of film retention. Both methods are illustrated herein and can be used to advantage depending upon dental conditions and the ability of the patient to cooperate with the operator. It must be remembered that films should be placed in the mouth with very little bending as better radiographs will always result if this is observed.



BITE BLOCK—The use of the bite block is recommended for simplicity and accuracy of technique and may be used in all areas where the teeth are present excepting in very abnormal cases of malocclusion. It will be found that the wood block can be used in practically every area without excessive bending of the film which reduces chances of distortion to a minimum.

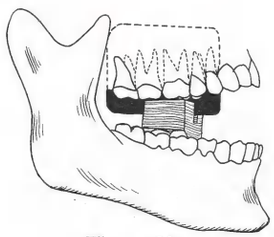


Figure 20

Wood block film holders can be obtained from all leading dental supply houses and are furnished in different width of slot for use with the thin radiatized film packet or the regular No. 1 thicker film packet.

INSERTING FILM — Insert the film in the slot of the block with the sensitive or plain side toward the biting surface as illustrated.

Figure 21

Placing the wrong side of the film towards the X-rays will cause the radiograph to be a failure, as one side of the film has a lead backing for the purpose of producing better contrast and detail, by eliminating to a certain degree secondary radiation.

The wood block should be placed between the occlusion of the teeth and the patient instructed to bite on it and not move during the exposure.

The bite will always remain sufficiently open to observe the position of the film and permit for a slight manipulation to allow the occlusal edge of the film to extend about one-eighth of an inch below and parallel to the line of occlusion in the upper jaw, and one-eighth of an inch above and parallel to the line of occlusion in the lower jaw. This is illustrated in Figure 20.

When placing the film for radiographing upper molars, gagging may be encountered. This can usually be prevented by placing the film in the bicuspid area first, and gradually sliding it backward to the molar region. Then, too, if the wood block film-holders are used, upon which the patient bites, this will cause the muscles of the mouth to relax and prevent gagging.

In placing the film for molars, the front edge or anterior border should be slightly ahead of the mesial surface of the first molar, Figure 20. This will in every case include all three molars, and will not be far enough back to cause gagging.

When adjusting the film for the lower teeth, the film is inserted on a slant toward the base of the tongue, then straightened up and drawn against the teeth and gums. It will cause the patient very little discomfort.

In all cases, care should be exercised to have the occlusal border of the film parallel to the occlusion of the teeth as the appearance to a mounted set of radiographs with the teeth in uniform alignment suggests the use of careful procedure in technique.

DIGITAL METHOD—If the thumb or fore finger method is used, Figure 22, the film should be carefully placed by the operator, who should demonstrate the desired amount of pressure with which the film packet should be held in place and instruct the patient to hold the film in that position without moving the head or film.

The patient should be carefully shown how to hold the film in the mouth, and told of the importance of not letting it slip from the correct position, and not to tilt the head.

Figure 22

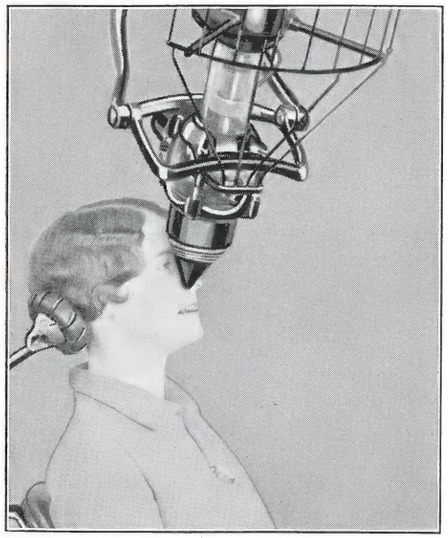


Figure 23

BITE METHOD—Occasionally, a patient is encountered with an extremely low or high and narrow palate in the upper central, lateral and cuspid regions, in which case it is impractical to use the bite block or even the digital method of film retention.

A very simple method is then substituted by allowing the patient to hold the film between the incisal edges of the teeth as shown in Figure 23. The short axis of the film should be placed parallel to the incisal edges. The flat plane of the film will then be horizontal and free from bending, which, when exposed at an angle of 65 degrees downward, will produce the correct root lengths.

Operative Exposure Technic

The Ritter X-Ray Machine is so designed that all factors entering into radiographic technic are predetermined and standardized, therefore it is reasonably certain that an X-ray film properly exposed and properly developed will produce a radiograph possessing all of the bone and soft tissue detail essential for an authentic diagnosis.

To familiarize the operator with the application of these factors we offer the following explanations which will bring about a more intelligent use of the machine and serve as a guide in the simplified procedure of standardized technic.

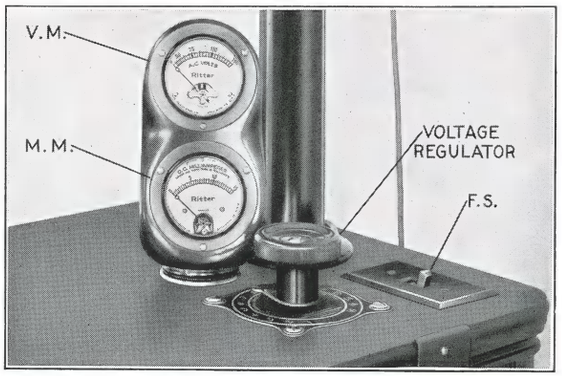


Figure 24

PENETRATION (voltage)—X-ray penetration is an important factor and depends upon the proper voltage, which in turn determines the degree of contrast and detail on the film. When turning on the filament switch (F.S. Figure 24) the voltage will be recorded on the voltmeter (V.M. Figure 24) any deviation from the correct voltage indicated by the marker on the voltmeter can be corrected by the voltage regulator on top of the cabinet (see cut). For alternating machines the voltmeter should record 110 volts *at the time exposures are being made*, while with direct current machines the voltmeter should record 75 volts *at the time of exposure*. Always have the voltmeter needle register slightly ahead of the prescribed readings to allow for a drop in voltage, the true reading being when operating the machine.

MILLIAMPERAGE—The X-ray tube used on the Ritter machine is designed to operate on approximately 10 milliamperes. All machines are adjusted at the factory to deliver the correct milliamperage for that particular tube when the voltmeter reading is correct. Having the voltage properly set, will insure the correct milliamperage, as the voltage regulator on top of the cabinet controls both voltage and milliamperage. A slight variation in the milliamperage reading as shown by meter M.M., Figure 24, is not to be regarded as serious providing the voltage remains constant, although extreme variations from the 10 milliampere reading are usually the result of operating a tube over a long period of time or a change in line voltage, and can be corrected by adjusting the regulator on the top of the cabinet. A uniform reading in milliamperage can thus be obtained as well as that of *voltage*, the more important factor.

DISTANCE—The employment of a uniform target film distance is essential to a full mouth examination in producing uniformity of detail throughout. To affect this result the factor of target distance is standardized by always placing the point of the bakelite cone in contact with the patient's face. This distance being 8 inches corresponds with that recommended by all professional authorities of the 3 inch machine.

The cone acts as a filter for the short rays which have very little penetration and would also be detrimental to the patient otherwise.

CENTRAL RAY—The point of the cone is a positive means of directing the central ray or parallel beam of radiation through the area of most vital interest, in this way distributing the entire source of radiation evenly over

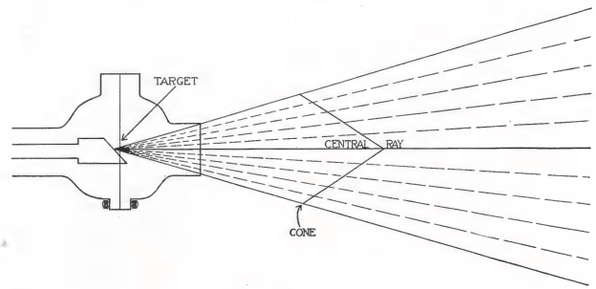


Figure 25

the entire area to be exposed. The point of the cone is in direct alignment with the target of the tube, Figure 25, and should be always directed at the apices of the teeth to afford a registration of any incipient stage of pathology. The cone should not be removed when making any exposures.

ANGULATION—The angles recommended in the Ritter exposure chart are applied to the calibrated scale "A" and are predetermined correct for the average patient when the head is in the correct position as explained on page 19, Figures 13 and 14.

TIME OF EXPOSURE—By having definitely set all previous factors, the time of exposure is the only remaining one to be manipulated, this being charted for the various teeth, and classification of the patient's jaw, such as small, medium, or large and according to the speed of film being used. (See exposure chart.) The automatic time switch is set by turning the graduated dial to the left for the number of seconds to be exposed. Pressing the button all the way down with the thumb makes the exposure and automatically cuts off the current when the time is completed.

Summary of Operative Procedure

1. Have patient seated comfortably with the head held firmly in the position as shown in Figures 13 and 14.
2. Ascertain the angle to be used by referring to exposure chart, then adjust tube so that the angle is properly set on Scale "A."
3. Operator should assume a position in front of patient and place the film in the mouth.
4. Bring the tube to the patient's face allowing the point of the cone to touch, maintaining the angle previously set on Scale "A" and observing that the horizontal angle of the tube is correct.
5. Turn on the filament switch and note that the voltmeter reading is correct (if not, adjust the regulator as described under heading of "Penetration.")
6. Remove the time switch from hook and set the dial for the number of seconds indicated on the Ritter Exposure Chart.
7. Step away from the high voltage wire and radiator end of the tube as far as the time switch cord will permit, and keeping the eyes on the patient, press the time switch button all the way down until the current is automatically turned off.
8. Hang time switch on the hook and turn off the filament switch.
9. Remove the film from patient's mouth and place in a lead box, or at a safe distance from repeated exposures made with the tube, until ready to develop.

Important Notes

1. Never hold the time switch button in an intermediate position; it must be held either entirely down or allowed to come clear up. This is very important, and if these instructions are not followed a resistance used in connection with the Time-Switch is likely to be destroyed.
2. To get good radiographs the current must be approximately 10 milliamperes while exposures are being made, and the voltage correct, as explained in preceding pages.
3. To get good radiographs the end of cone must be placed against the face or not over ¼ inch away from face.
4. Turn on the filament current only at the time when ready to make an exposure.
5. The tube must not be positioned with the time-switch in the hands of the operator or any other person. The switch should be on the hook, to be removed by the operator when ready to make the exposure.

6. To get good radiographs the two "Primary Wires" in cabinet must be properly connected to the high-voltage transformer, as explained in the Operator's Manual.
7. When adjusting the machine the time-switch must be on the hook.
8. Under no circumstances allow assistant or operator to hold the film in patient's mouth during exposure.
9. Operator should not stand in direct path of rays when making exposures.
10. When making exposures, stand as far away as time-switch cord will permit.
11. The radiator end of X-ray tube must not be closer than 12 inches to patient or any object. It will not be necessary if you follow our technic.
12. Dust should not be allowed to accumulate on the tube shield, for in time this may become a conductor of electricity.
13. Unscrew the bakelite cone occasionally to see that no foreign particles or chips of leaded glass have accumulated in the point, otherwise there may be spots on the film.
14. Do not operate the machine when the tube and arm are in a folded position.

The quality of X-rays generated by the Coolidge tube and by a gas tube, with focal spots of the same size, is identical provided the voltage and milliamperage are the same. Therefore, with the right angle radiator-type tube it is not only possible to obtain as good radiographs as with the gas tube, but better bone detail is secured due to the extremely fine focal spot.

This type of tube also affords protection to the operator as it is completely enclosed in a lead-glass shield, which confines the X-rays to the area to be radiographed.

This lead glass is equivalent in protection to over $\frac{1}{16}$ inch of lead so that danger of X-ray burns is eliminated provided the operator does not place himself in the direct path of the rays.

In the figures that follow, we show the end of the cone in contact with the face of the patient. We believe this is good practice to follow, but it is not absolutely necessary, for some operators prefer to keep it about one-fourth inch away, to which there is no objection.

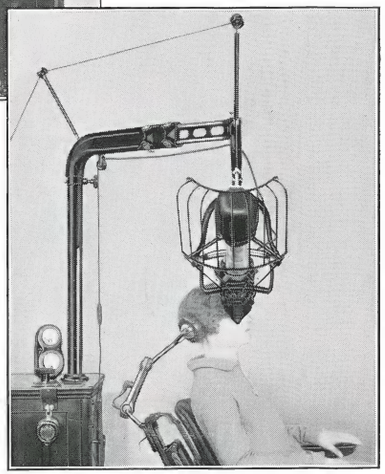


Figure 26

Position of X-Ray Tube for Radiographing Upper Molars

1. Place head in position as explained under Figures 13 and 14.
2. Referring to Scale A, set tube at 25 - 30 degrees downward as shown above.
3. Place film in the mouth in a horizontal position.
4. Place cone in contact with patient's face on a line extending through apices of teeth (from ala of nose to tragus of ear) at a point directly below the corner of the eye. Direct the rays through the teeth parallel to the proximal surfaces.
5. Make exposure in accordance with information given in Ritter X-Ray Exposure Chart.

Note—

If radiographs are being made to ascertain root canal conditions, they should be taken both mesially and distally, as explained on page 21.

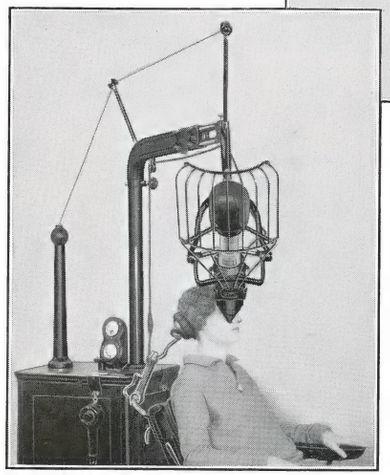


Figure 27

Note—
If radiographs are being made to ascertain root canal conditions, they should be taken from a mesio-distal direction as explained on page 21.

Position of X-Ray Tube for Radiographing Upper Bicuspids

1. Place head in position as explained under Figures 13 and 14.
2. Referring to Scale A, set tube at 35 - 40 degrees downward as shown above.
3. Place film in the mouth in a horizontal position.
4. Place cone in contact with patient's face on a line extending through apices of teeth (from ala of nose to tragus of ear) at a point directly below the pupil of the eye. Direct the rays through the teeth parallel to the proximal surfaces.
5. Make exposure in accordance with information given in Ritter X-Ray Exposure Chart.

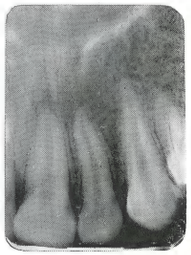
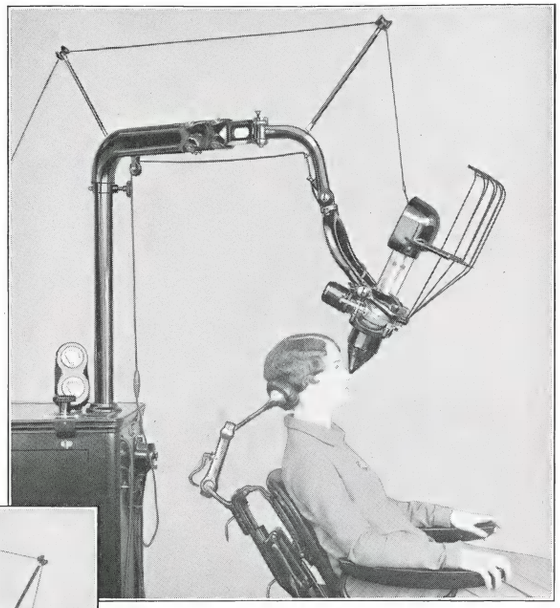


Figure 28

Position of X-Ray Tube for Radiographing Upper Right Cuspid and Lateral

1. Place head in position as explained under Figures 13 and 14.
2. Referring to Scale A, set tube at 45-50 degrees downward as shown above.
3. Place film in the mouth in a vertical position.
4. Place cone in contact with patient's face on a line extending through the apices of teeth (from ala of nose to tragus of ear) directly at the ala of the nose. Direct the rays through the teeth parallel to the proximal surfaces.
5. Make exposures in accordance with information given on Ritter X-Ray Exposure Chart.
6. If the film is held by the bite method, set tube at 65 to 70 degrees pointing downward.



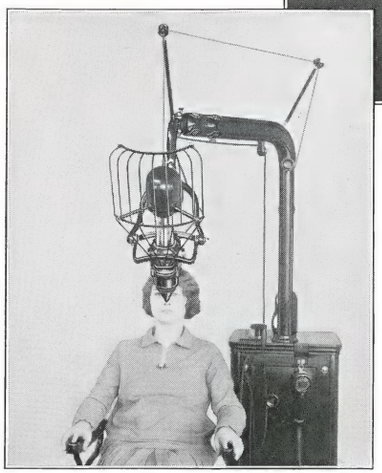
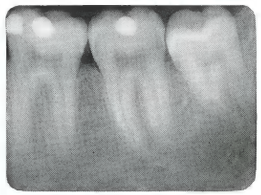


Figure 29

Position of X-Ray Tube for Radiographing Upper Centrals

1. Place head in position as explained under Figures 13 and 14.
2. Referring to Scale A, set tube at 45-50 degrees downward as shown above.
3. Place the film in the mouth in a vertical position.
4. Place cone in contact with tip of nose and direct the rays between the central incisors, keeping the long axis of the tube parallel to the median line.
5. Make exposure in accordance with information given on Ritter X-Ray Exposure Chart.
6. If film is held by the bite method, set tube at 65 to 70 degrees pointing downward.



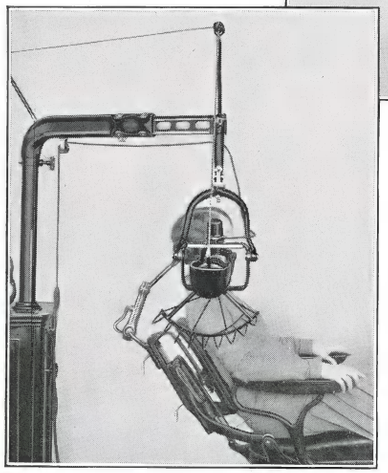
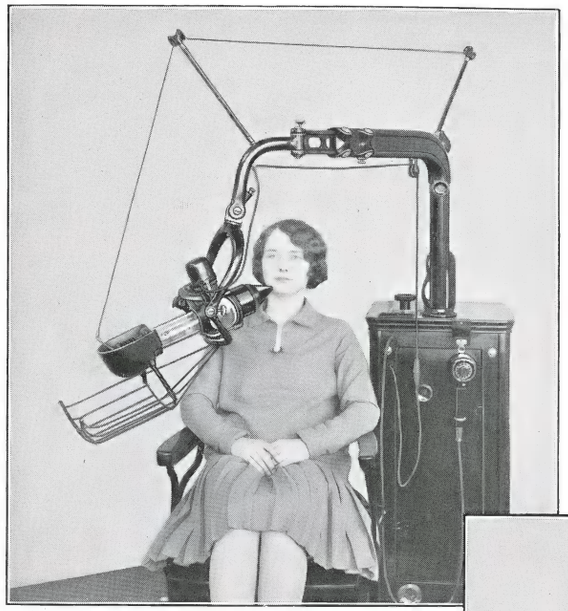


Figure 30

Position of X-Ray Tube for Radiographing the Lower Molars

1. Place head in position as explained under Figures 13 and 14.
2. Referring to Scale A, set tube at 0 - 5 degrees as shown above. In this position the ray will be directed at right angles to the plane of the teeth, inasmuch as the film and teeth are practically parallel.
3. Place film in the mouth in a horizontal position.
4. Place cone in contact with patient's face at lower border of mandible (on line extending through apices of teeth), at a point directly opposite second molar. Direct the rays through the teeth parallel to the proximal surfaces.
5. Make exposure in accordance with information given on Ritter X-Ray Exposure Chart.



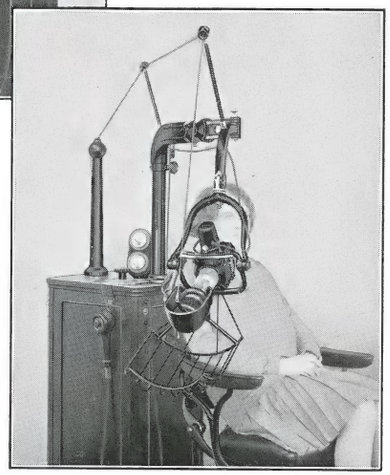
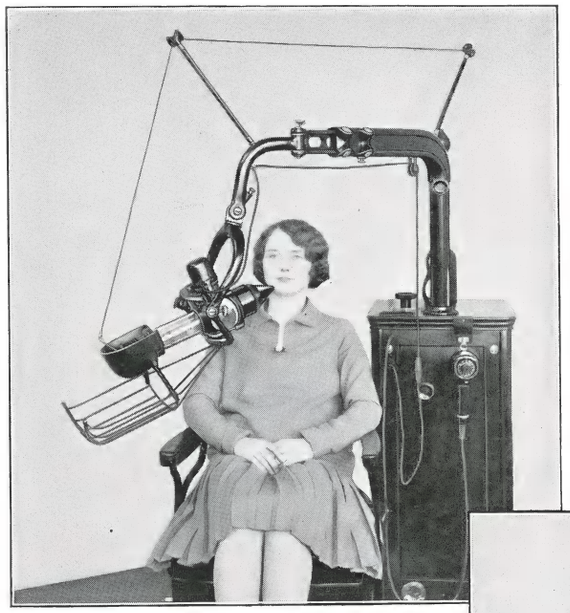


Figure 31

Position of X-Ray Tube for Radiographing Lower Bicuspids

1. Place head in position as explained under Figures 13 and 14.
2. Referring to Scale A, set tube at 10 to 15 degrees upward as shown above.
3. Place film in the mouth in a horizontal position.
4. Place cone in contact with patient's face at lower border of mandible on line extending through apices of teeth, at a point midway between first and second bicuspids. Direct X-rays through the teeth parallel to proximal surfaces.
5. Make exposure in accordance with information given on Ritter X-Ray Exposure Chart.

Note—
If a unit is in the office, it will be advisable to rotate the chair clockwise a little when making radiographs of the lower cuspids and bicuspids, otherwise the tube protector may interfere with the unit.



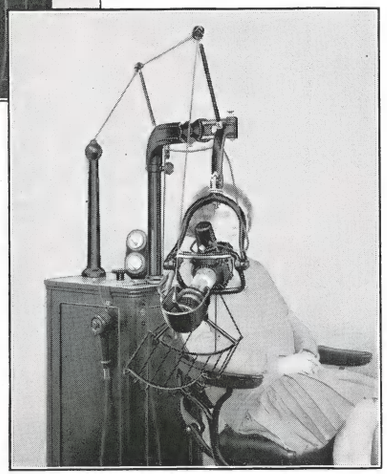
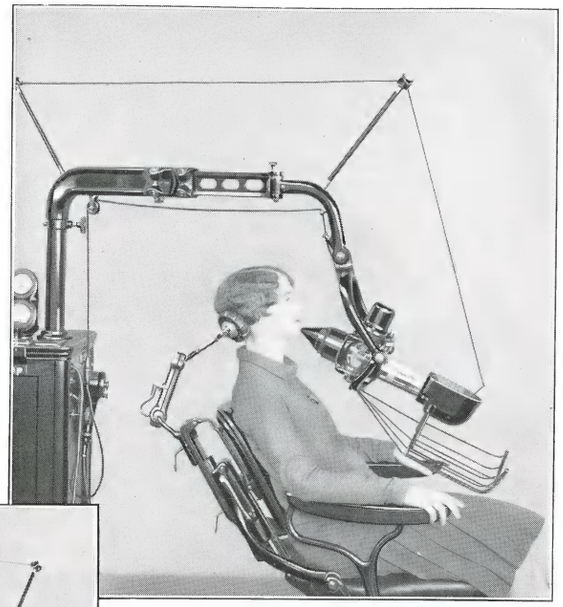


Figure 32

Position of X-Ray Tube for Radiographing Lower Cuspid Region

1. Place head in position as explained under Figures 13 and 14.
2. Referring to Scale A, set tube at 20 degrees upward as shown above.
3. Place film in the mouth in a vertical position.
4. Place cone in contact with patient's face at lower border of mandible on line extending through apices of teeth directly at cuspid tooth. Direct X-rays through the tooth parallel to the proximal surfaces.
5. Make exposure in accordance with information given on Ritter X-Ray Exposure Chart.



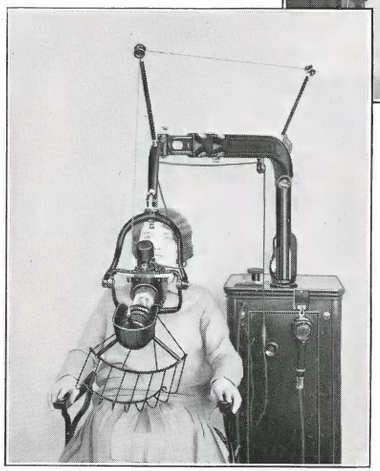


Figure 33

Note—
When radiographing the lower incisor region instruct patients not to cross the knees.

Position of X-Ray Tube for Radiographing Lower Incisor Region

1. Place head in position as explained under Figures 13 and 14.
2. Referring to Scale A, set tube at 15 to 20 degrees upward as shown above.
3. Place film in mouth in a vertical position.
4. Place cone in contact with patient's face touching chin on line extending through apices of teeth, directly between the two central incisors. Direct the rays between the central incisors keeping long axis of tube parallel to the median line.
5. Make exposure in accordance with information given on Ritter X-Ray Exposure Chart.

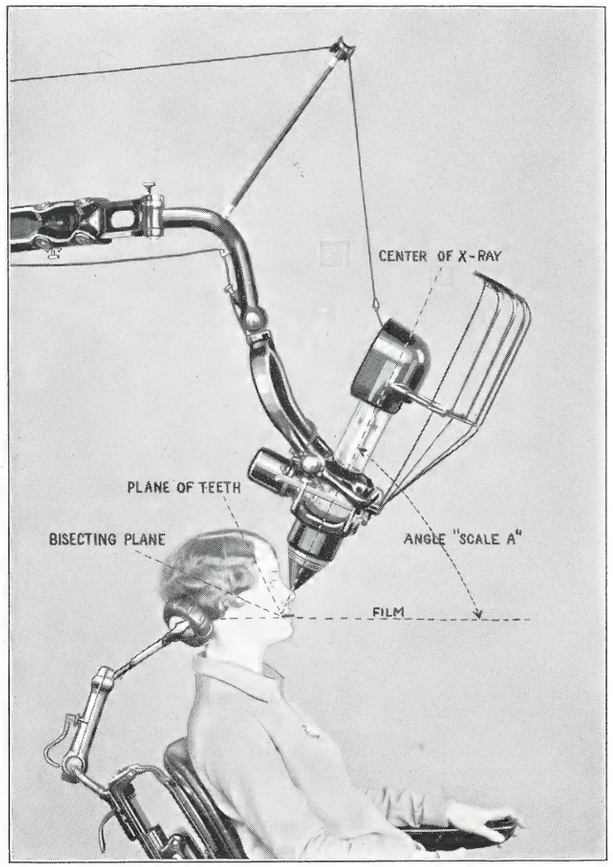


Figure 34

Position of X-Ray Tube for Radiographing Upper Centrals Using the Bite Method

1. Place head in position as explained under Figures 13 and 14.
2. Referring to Scale A, set tube at 65 to 70 degrees downward as shown above.
3. Place film in the mouth in a vertical position, held between the incisal edges of the teeth and extending well back in the mouth.
4. Place cone in contact above tip of nose. Direct the rays between the central incisors, keeping the long axis of the tube parallel to the median line.
5. Use No. 1 or No. 2 either "Regular" or "Fast" dental film, held between the occlusal surfaces of the teeth, with the film well back in the mouth.

Note—When using the No. 2 occlusal film the bite method of making exposures is excellent in the case of impacted cuspids, cysts or necrosis, and in the lower jaw is often used for locating fractures in the anterior part of the mandible. Also indicated where a narrow and constricted anterior arch prevails.

Exposure 7 seconds, regular slow film. Exposure 2 seconds, fast film.
Exposure 3½ seconds, radiatized film.

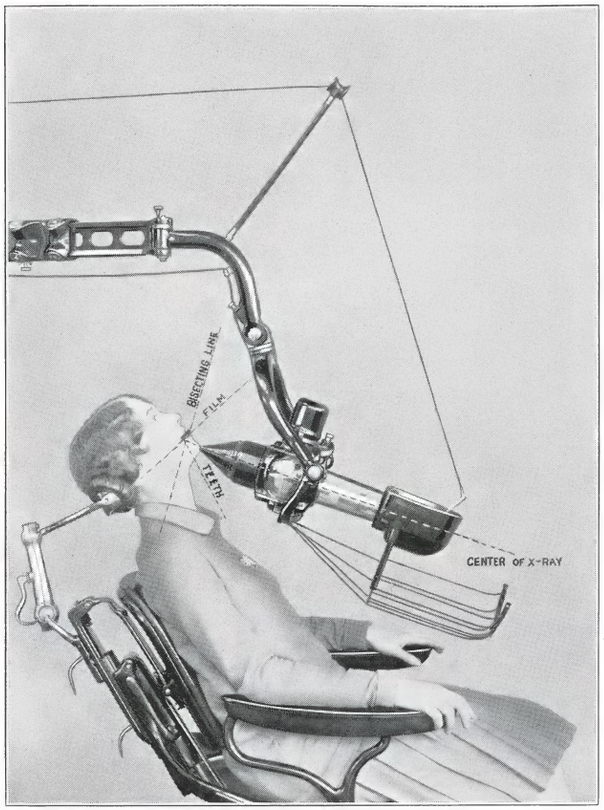
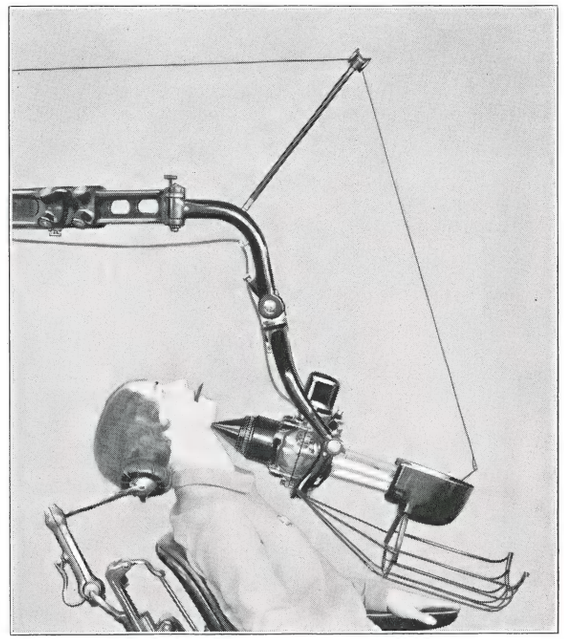


Figure 35

Position of X-Ray Tube for Radiographing Lower Anteriors Using the Bite Method

1. Tilt the head backward so the plane of the lower incisors is about 50 degrees from horizontal, as shown above.
2. Referring to Scale A, set tube at 20 degrees upward as shown above.
3. Place film in the mouth in a vertical position, held between the incisal edges of the teeth.
4. Place cone in contact with chin on line extending through apices directly between the two central incisors, keeping the long axis of the tube parallel to the median line.
5. Use the ordinary dental film or No. 2 Bite-film, either "regular" or "fast," held between the occlusal surfaces of the teeth, with the film well back in the mouth.

Exposure 5 seconds, regular slow film. Exposure 1½ seconds, fast film.
Exposure 3 seconds, radiatized film.



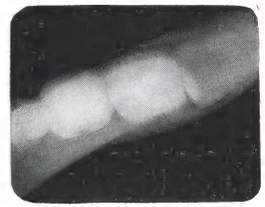


Figure 36

Position of X-Ray Tube for Occlusal View of Impacted Lower Third Molar

To facilitate the surgical removal of impacted mandibular third molars, the occlusal radiograph may be taken to obtain a correct definition where the impaction is deflected in an extremely buccal or lingual position as compared with the position of the second molar.

This radiograph may be taken with the small dental film, preferably the No. 1 extra fast or the No. 1 radiatized.

The patient is seated in the dental chair in a semi-reclining position with the head tilted backward and turned to the right or left as the case may require.

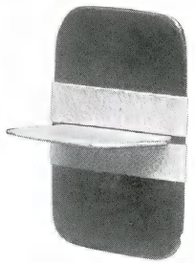
The film is inserted well back with the emulsion side down and against the occlusal surfaces of the 1st, 2nd and 3rd molars, allowing the patient to bite, thereby securely holding the film from slipping out of position.

The tube is adjusted so that the point of the cone is approximately touching the inferior border of the mandible, with the central rays directed at right angles to the film, or parallel with the long axis of the 1st and 2nd molar teeth. Figure 36 shows the correct position for the occlusal view of lower third molar impactions.

Exposures with radiatized films 6 *seconds*
Exposures with extra fast or speed films 4 *seconds*

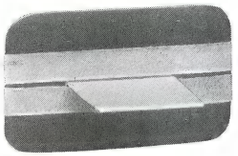
Eastman Bite-Wing Dental Film Packets for Interproximal X-Ray Examinations

The purpose of the interproximal X-ray examination is to supplement the instrumental method, thereby definitely revealing the presence of all interproximal cavities, overhanging fillings, pyorrhetic conditions, resorption of bone, pulp stones, the occlusion of the teeth and lack of restoration all toward a means of detecting the more incipient conditions, before their progress has reached a stage where devitalization of teeth takes place or other serious consequences follow. This method affords a considerable saving of time where the history of the patient is already known and periodical examinations are made to form an intelligent and accurate diagnosis in the practice of preventive dentistry, as outlined in Dr. Raper's book "Clinical Preventive Dentistry."



Type 1
For Anterior Teeth

COMPLETE INTERPROXIMAL EXAMINATION: To make an interproximal examination of the entire mouth on Bite-Wing films requires only five (or seven) exposures; just one-half the number required for a periapical dental examination. Both upper and lower teeth (the coronal two-thirds) are radiographed simultaneously on the same film. Bite-Wing film packets for five-film examinations are supplied in two sizes: Type 1, special size anterior, and Type 3, special size posterior as illustrated.



Type 3
For Posterior Teeth

To make a complete interproximal examination in five exposures, use three Type 1 packets for the anterior teeth, and two Type 3 packets for the posterior teeth. If seven films are to be used, use four Type 2 (standard size) packets for the posterior teeth.

POSITION: The position of the head during exposure should be such that a line drawn from the tragus to the ala is horizontal. X-ray angle: Tip the tube to eight or ten degrees above the horizontal. Position of the film: The film packet proper containing the film goes inside of the mouth, back of the teeth, while the patient bites on the Bite-Wing.

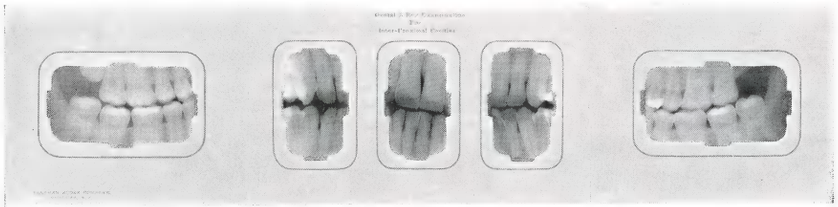
PLACING THE FILM IN THE MOUTH: Placing Bite-Wing film packets in the mouth is a simple matter, but it is something which must be learned like any other technic. Place the film packet nearly in position for the usual radiograph of the upper or lower teeth, usually the lower. Then have the patient bite slowly on the Bite-Wing. Do not pull on the Bite-Wing in an effort to bring the face of the film up tightly against the teeth; it is not necessary and it may cause excessive bending and discomfort to do so.

POSTERIOR TEETH: The technique, in detail, for placing the posterior packets in the mouth may be summarized as follows: (1) Bend the upper front corner to compensate for the roof of the mouth in the anterior region. Bend the lower front corner slightly for comfort. (2) Put the film

packet practically in place for the lower teeth. (3) Let the front edge of the packet come forward into the incisal region. (4) Do not pull on the Bite-Wing in an effort to pull the film tight up against the teeth, as the curvature of jaw will not allow it to rest closely against them. (5) Let the whole upper part of the packet slant inward into the palatal vault. (6) Have the patient bite slowly.

ANTERIOR TEETH: When raying the anterior teeth the patient should bite with the teeth end-to-end to avoid overlapping of the upper and lower teeth. Slightly bend back all corners. When in position, the packet should bend, or break, in the middle on a line with the Bite-Wing. To make the placing of the film packets easier for both operator and patient, cotton rolls may be used in connection with the anterior packets. Place a ready made medium size cotton roll on each side of the Bite-Wing and against the face of the packet, and hold in position by means of a suitable adhesive. Almost any radioparent adhesive may be used, including the dusting powders for false teeth. The cotton rolls are not needed on posterior packets.

EXPOSURE: The time of exposure is 5 seconds for the posterior region and 3 seconds for the anterior region. After exposure upon removing the packet from the mouth, it is expedient to blot off the moisture with a napkin or blotting paper.



Five-opening mount for the *Bite-Wing* interproximal examination.

MOUNTS: It will be found a great convenience to mount negatives in their anatomical relation to one another. An Eastman five-window and seven-window mount for interproximal negatives has been made especially for this purpose.

Stereoscopic Technique with the Ritter X-Ray Machine and Intra-Oral Stereoscope

When the ordinary X-ray film packet is placed in the mouth and properly exposed to X-ray radiation, a plane shadow representation is the result which, while valuable, is only of a limited character when localizing impactions, supernumerary teeth, unerupted teeth, the abnormalities of multi-rooted teeth, the relation of foreign objects to sinuses and the extent of numerous pathological lesions.

The plane radiograph gives but two dimensions, length and breadth. The third dimension is made possible by simultaneously viewing two films which have been exposed from slightly different angles representing the pupillary distance so that the fusion or blending of these two films in the Ritter Stereoscope produces upon the eye the impression of relief or depth, known as the third dimension.

To produce depth radiographically, it is necessary to take two radiographs, one at the angle at which the right eye would view the area, were it possible to see through the tissue; and the other at the angle at which the left eye would view the area. Referring to Figure No. 37 this means two radiographs are taken a definite distance apart which is known as the inter-pupillary distance. Both radiographs must be focused on exactly the same spot.

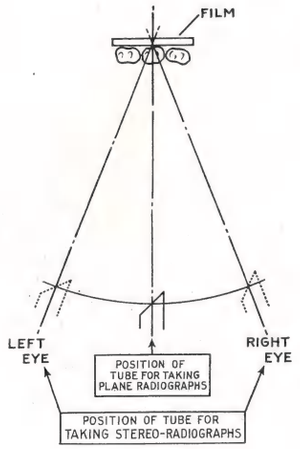


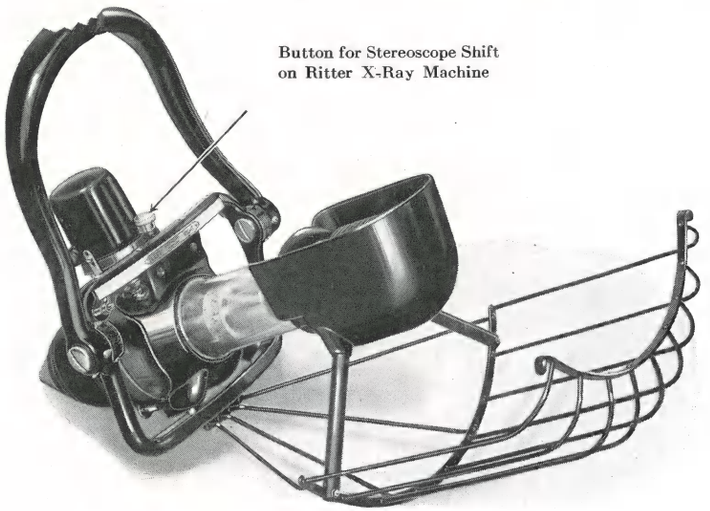
Figure 37

Exposure Technique for Stereoscopic Radiographs

The procedure for taking stereoscopic radiographs has been simplified through the stereoscopic shift on the Ritter X-Ray Machine. This shift is provided with stops which definitely determine the length of the stereoscopic shift and the slide over which the shift is made is grooved at the proper arc to obtain correct angulation. The combination of these two features eliminates the uncertainty that is always a part of taking such radiographs with an ordinary X-ray machine.

The following steps give the procedure to be followed when exposing films:

1. Place patient's head in the correct position for taking an intra-oral radiograph.
2. Instruct the patient that two pictures are to be taken and that he should not move the head from the beginning to the end of the work.
3. The film is placed in the mouth in the usual manner except that some provision must be made to definitely locate the position of the first film so that the second film can be placed in exactly the same position. This can be accomplished with the film holders that are made for the



Button for Stereoscope Shift on Ritter X-Ray Machine

Figure 38

purpose or a little modeling compound can be placed on the regular wood block film holder which will take an impression of the teeth as it is held between the bite, permitting the operator to place the second film in the same position occupied by the first.

Figure 39

For the upper anterior teeth it is advisable to dispense with the wooden block and use the bite method of holding the film between the incisal edges of the teeth. The film may be slipped into the corner of an envelope cut to the size of film, and while it is held between the bite, a lead pencil tracing of the teeth should be made on the envelope. The second film is then inserted in the same envelope and can be accurately placed in the same position as that occupied by the first. This method also applies to the Eastman No. 2 Occlusal (Bite) Films.

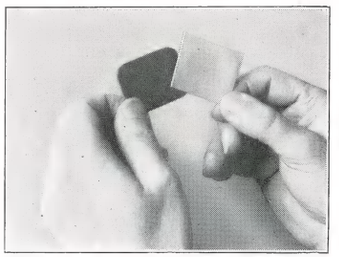


Figure 40

4. Place the tube in proper position for taking an ordinary radiograph and lock all movable parts of the machine, Fig. 41.
5. Raise the button, Figure 38, of the stereoscopic shift slightly, and give it a quarter turn. Move the tube to the right until it stops, Figure 42.
6. Expose film using the correct exposure for the area involved.
7. Carefully remove film from patient's mouth. Mark the film "right" and remove from block, replacing it with an unexposed film marked

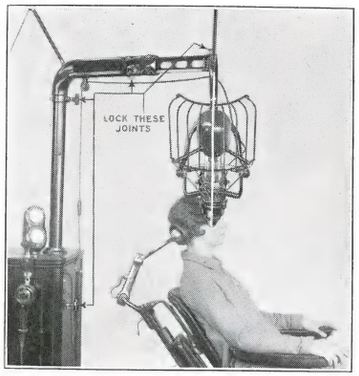


Figure 41

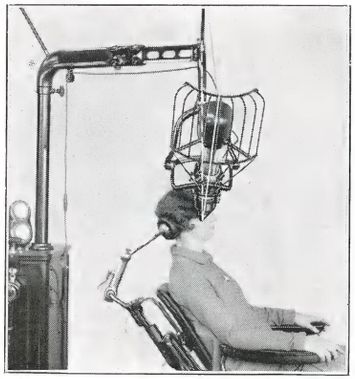


Figure 42

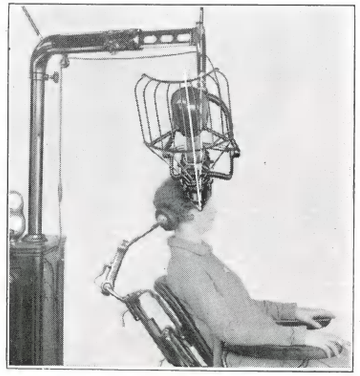


Figure 43

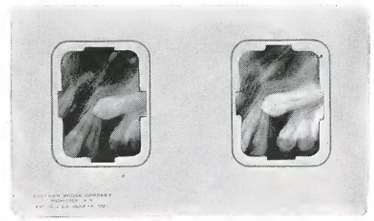
"left." It is important to place the second film in exactly the same position in the block as that occupied by the first film.

8. Replace the bite block with the un-exposed film in the patient's mouth, fitting the cusps of the teeth into the impression in the modeling compound. This definitely locates the film in the same position as was occupied by the first.

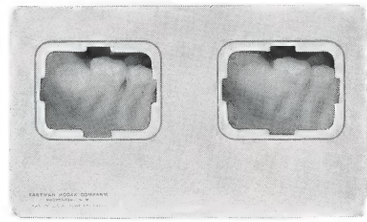
9. Move the stereoscopic shift back across center to the left until it stops, Figure 43. Expose the film using the same time exposure as was used for the first film.

Developing and Mounting Films

After entering the dark room, mark the film taken from the right side, so identification will be permanent. A good method is to perforate a small hole through a corner of the film packet with a pin, in a position where it would not be mistaken for a developing hanger mark, or obscure any diagnostic portion of the film.



Two-opening (periapical) vertical mount*



Two-opening (periapical) horizontal mount*

After films have thoroughly dried they are mounted in an Eastman* two-window stereoscopic film mount, which has the window centers located at 2½ inches or interpupillary distance apart. They are mounted with the film taken from the right side of the stereoscopic shift, in the right window of the mount.

It is considered good practice to mount one set of films with the shiny side toward the operator and mark it "lingual aspect." The other set is mounted with the dull side toward the operator and is marked "buccal aspect." This enables the operator to examine the involved area thoroughly from both sides.

The fusion of the two films through the four delicate adjustments on the Ritter Stereoscope make it possible to view the third dimension or depth of the oral cavity, affording the operator a valuable diagnostic reading not obtainable in any other way.

Operation of Ritter Stereoscope

In viewing films through the stereoscope the following procedure should be followed:

1. Lift up the latch which holds the front, or binocular section of the stereoscope in position and place the film mount under the clip provided for that purpose, Figure 44. Center the film mount up as accurately as possible with the eye, and close the stereoscope.
2. Illuminate the stereoscope by means of the regulating switch located in the base, Figure 45. Better results are usually obtained by using a soft illumination rather than a bright light.

Ritter Intra-Oral Stereoscope and Diagnostic Lamp

These mounts may be purchased through your dealer from the Eastman Kodak Co.

3. In order that the films may be accurately superimposed, or fused together, two adjustments have been provided. The lens mounts rotate for correction of variations in the inter-pupillary distance of different individuals, Figure 46, and the entire binocular section of the stereoscope revolves to correct errors in film position or slight movement of the patient between exposures, Figure 47.

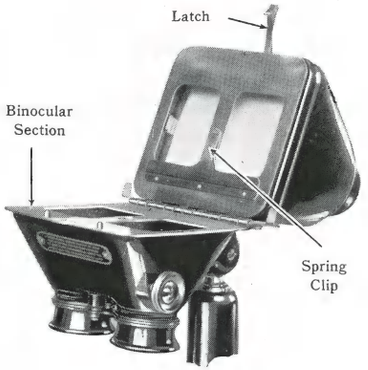


Figure 44

The easiest method of making these adjustments is to select some characteristic present in the film, such as a filling, to use as a guide while adjusting the stereoscope.

When first looking into the stereoscope, the picture will appear double. Revolve the lens mounts until these objects appear to be on a vertical plane, then revolve the binocular section of the stereoscope until they fuse together, showing that the films are properly superimposed.

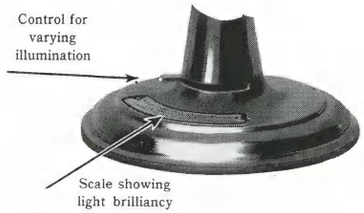


Figure 45

4. Adjust the knob on the upper right hand side of the binocular section to a point where the radiograph appears clearest, Fig. 46.

5. The regulator which adjusts the brilliancy of the light should now be adjusted until the detail of the picture shows to the best advantage, Figure 45.

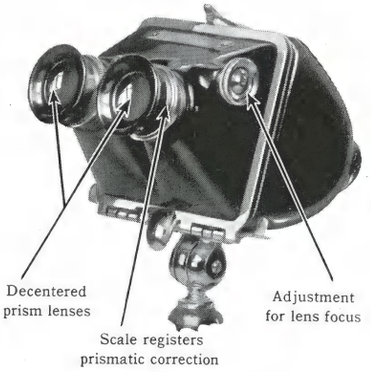
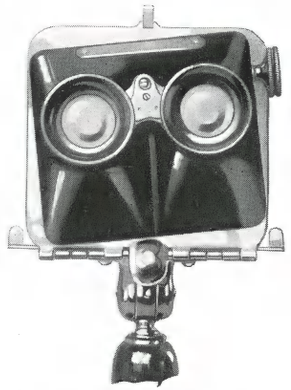


Figure 46

Features of Ritter Stereoscope

The lens mounts of the Ritter Stereoscope have been designed to rotate for correction of variations in the inter-pupillary distance of different individuals. Once the correct position of this adjustment has been ascertained, the reading of the graduated scale at the side of the right lens mount should be noted, as this adjustment will remain constant, merely varying between different individuals, Figure 46.



Adjustment for errors in film position or slight movement of patient

Figure 47

If ordinary films are to be viewed for diagnostic purposes, release the latch at the top of the stereoscope and drop down the front binocular section. This exposes to view the opalite glass surface which will permit laying films against its surface for study. Large full mouth examination mounts may be studied, supports being provided for the mount to rest on, Figure 49.

Some operators mount their stereoscopic studies between glass. These may also be observed in the stereoscope, a special mounting clip being provided for this purpose. To view these glass mounts, lower the front of the stereoscope and insert the glass under the clip on the back of the hinged leaf which supports the film mounts.

The spring clip on the back is especially designed for this purpose. Do not attempt to place glass mounts under the front spring clip, as this is designed to hold cardboard mounts only.

The regulating switch at the base of the stereoscope is designed so that the brilliancy of the light may be easily regulated. This is of great importance as it is necessary to vary the intensity of the light at times to bring out detail to the best advantage.

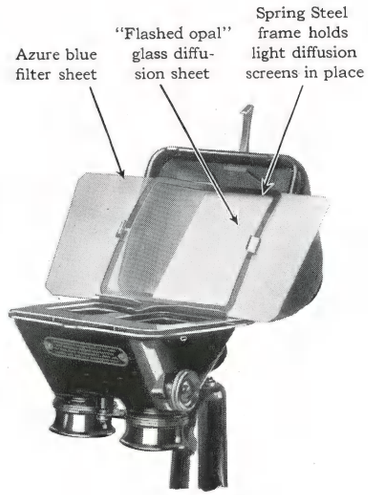


Figure 48

Bulb Replacement

Should the electric bulb burn out, it may readily be replaced by the following procedure. Drop down the front section of the stereoscope. Remove the spring frame which holds the glass. Ears are provided on either side of this frame to facilitate easy removal. Remove the opalite and daylight glass plates which will expose the bulb to view. The replacement bulb should be 40 watt size, inside frosted, as this type has been found to give the most satisfactory results. These bulbs may be procured from the Ritter Company at a nominal cost, or from any electrical dealer.

Figure 49

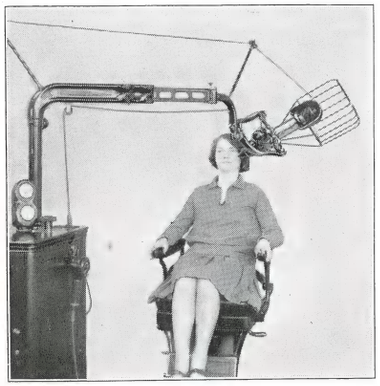


Figure 50
Tube in position for radiographing Upper Left Molars.

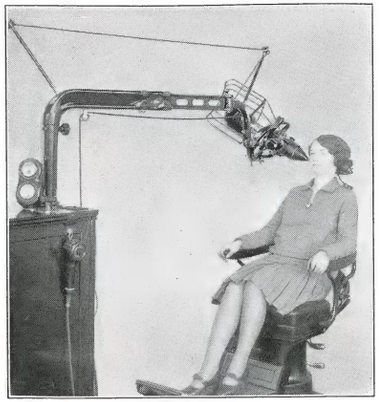


Figure 51
Tube in position for radiographing Upper Right Molars.

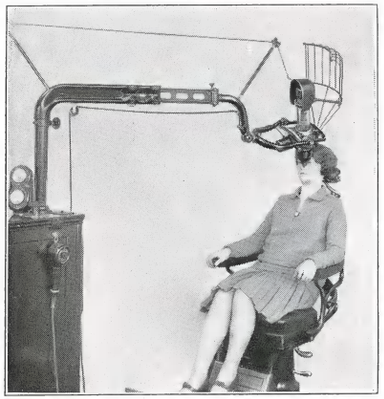


Figure 52
Tube in position for radiographing Upper Incisor Region.

Figure 53
Tube in position for radiographing Lower Incisor Region.

X-Ray Machine to Front of Chair

The illustrations on this page give an excellent idea of the use of the Ritter X-Ray Machine when located to the side and front of the chair seat.

To turn the yoke into the various positions shown, it is necessary to first pull out and set the thumb-screw located in upper part of yoke. Angles recommended in Ritter X-Ray Exposure Chart must now be read on Scale B instead of on Scale A. When machine is used in above positions, care must be taken that the high tension wire leading to the radiator on tube is kept at least six inches from any part of the arm or yoke, otherwise the current will jump across the gap and not pass through the tube.

Extra-Oral Radiographs

The intra-oral method of taking radiographs of the teeth, as explained in the foregoing pages, is the one usually followed to diagnose conditions of small localized areas such as in abscesses, root canal fillings, etc.

Such pictures are more distinct and always show more detail than extra-oral ones because they are taken from a position closer to the object, and there is less chance of distortion and superimposition of shadows. Sometimes, however, an intra-oral radiograph leaves some doubt, or only partly shows a certain condition, then extra-oral radiographs should be taken so as to get a view of the entire region involved.

The extra-oral or lateral jaw radiograph is indicated for the type of patient who gags or where lock jaw or any condition is present that makes it difficult to insert a small film into the mouth, also in fracture cases, the location of deep impactions, and is especially valuable in the cases of children where the intra-oral film cannot be adapted to the small mouth, and for all orthodontic examinations.

FILMS—When making extra-oral radiographs, the Eastman ultra-speed or diaphax films should be used, in conjunction with the suitable cardboard holders or with an intensifying screen. These films are half again as fast as the regular duplitized and the exposures following are charted accordingly. Diaphax film has a diffused base, while the ultra-speed is a clear base contrast film; the speed factor of both being equal. If an intensifying screen is not available, the film should be loaded into the cardboard holder in the darkroom with either side up, and the long paper flap closed over the film and then the two sides and bottom portions lapped over the film. After closing and latching both cardboards together, the film may be taken from the dark room. When loading the double intensifying screen be sure to remove the black, paper folder from the film. Both surfaces of the film must be in actual contact and compressed between the surfaces of the screens to obtain the maximum degree of detail.

POSITION TECHNIC—With the patient seated in the dental chair, tip the head backward and tilt it slightly toward the side to be radiographed, so as to elevate the angle of the opposite jaw. The tube side of the 5 x 7 or 8 x 10 film is held to the side of the jaw to be radiographed, allowing the film holder to remain about ½ inch from the tip of the nose.

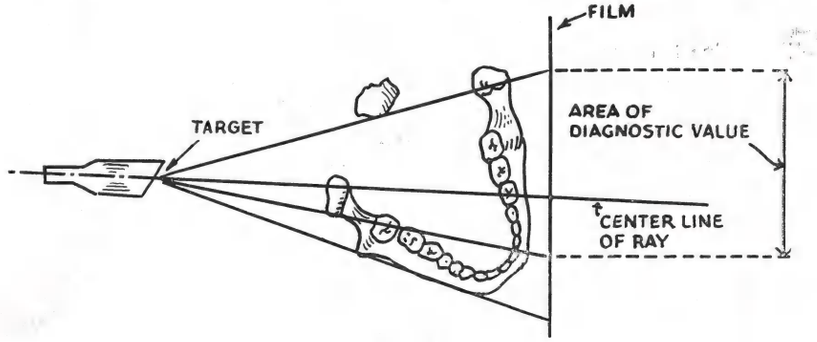
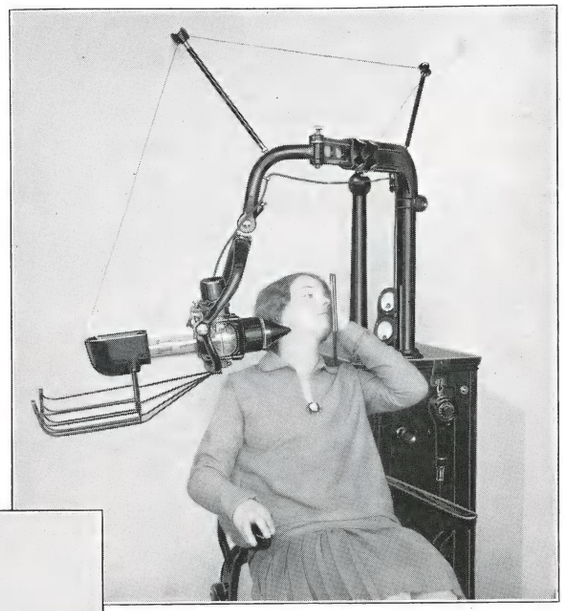


Figure 54



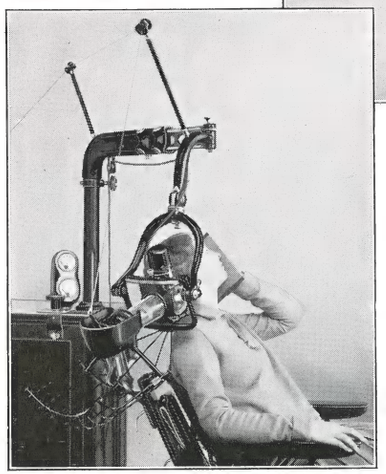


Figure 55

Position the tube so that the point of the cone directs the center ray just behind and below the ramus, and the lower border of the angle of the jaw, keeping the long axis of the tube at right angles to the plane of the film, so as to prevent any distortion. Due to anatomical variations in certain patients it may be found necessary to place a large cotton roll between the mandible and the film to maintain it at right angles to the long axis of the tube. Owing to variations in positioning the patient's head, accuracy is obtained by sighting the tube with the eye, eliminating the use of the scales on the machine.

The following diagram and cuts illustrate the manner in which the tube is directed to avoid superimposition of both sides of the jaw.

Exposure with double intensifying screen, ultra-speed or diaphax film..... 1½ seconds.

Exposure without intensifying screen, ultra-speed or diaphax film ..... 6 seconds.

The exposures recommended are of course only approximate and depend upon whether patients have small, medium or heavy jaws, the same as in intra-oral work. Age also should be considered.

It is important also to see that voltage and milliamperage are correct during the exposure, otherwise the time recommended will not apply.

Frontal and Maxillary Sinus

Figures 56 and 57 illustrate the method of making a Postero-anterior view of the head for a general examination of both frontal and maxillary sinuses.

In taking these radiographs use Eastman ultra-speed or diaphax X-ray film with double intensifying screen. Screens are recommended to reduce the time of exposure. Sufficient contrast cannot be obtained otherwise, unless the patient to be exposed is a child or a very light weight subject.

When loading the film into the cassette or screens be sure to remove the black paper folder from the film.

Backrest and headrest can be adjusted to support film in a horizontal position and so adapted to allow for the maximum comfort of the patient. The tube should be adjusted to a vertical position by setting the yoke at 45 degrees and then setting the tube between 60 and 65 degrees on Scale "A."

With patient seated in chair as shown, use an 8 x 10 duplitized ultra-speed or diaphax film, allowing chin and end of nose to rest against the exposure holder or cassette.

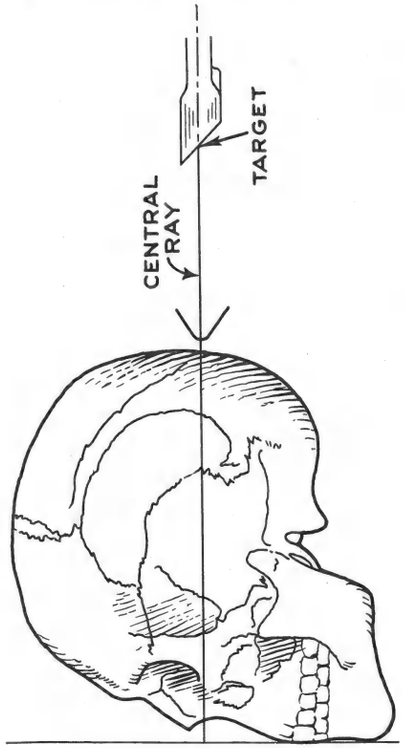


Figure 53

Place a coin or a lead letter "R" on top of the cassette and to the right corner of the patient's head as a suitable marker to identify the right from left side after the film has been developed.

The pointer or cone on X-ray tube should be directed above the occipital protuberance and with the central ray directed so it passes just below and between the orbits in a straight line perpendicular to the plane of the film and parallel to the sagittal plane.

Where anatomic variations of the head are such that the occipital protuberance is located very high it would be advisable to direct the central ray slightly lower with the tube tilted about 5 degrees toward the forehead. This will prevent obscuring the antrum with shadows of the petrus portion of the skull.

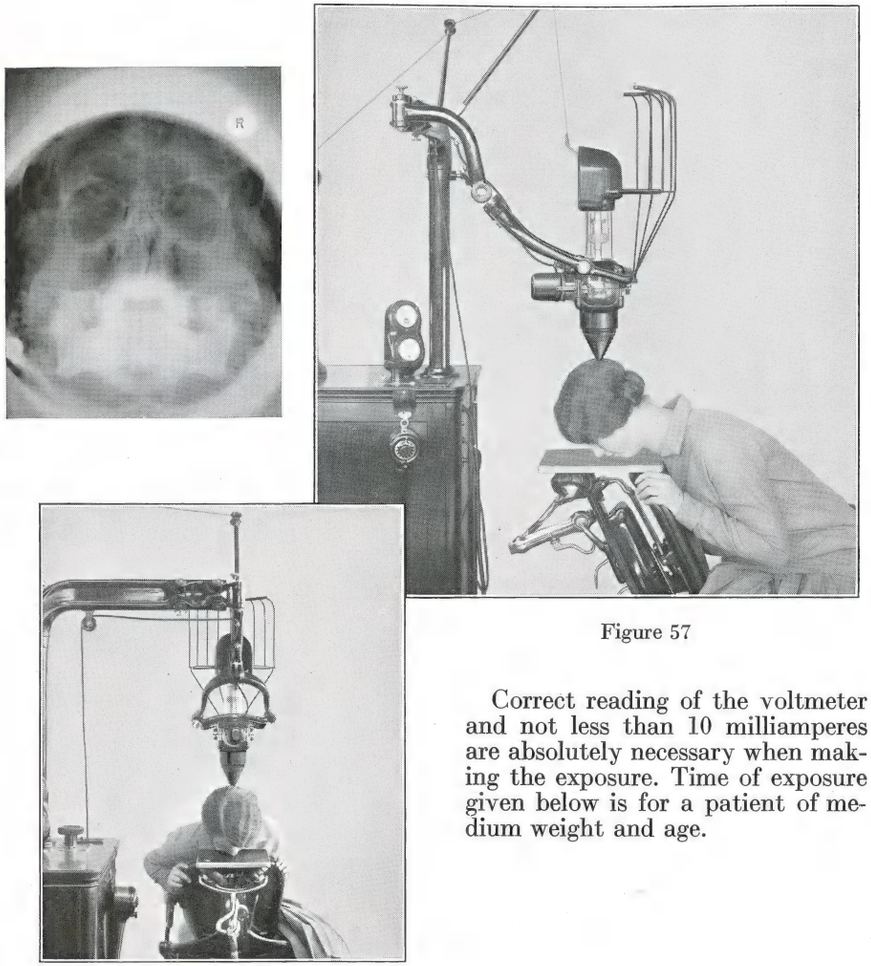


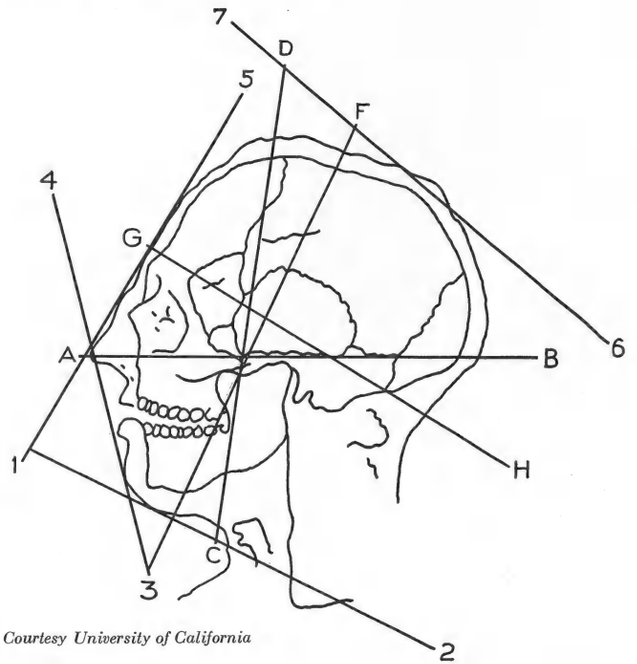
Figure 57

Correct reading of the voltmeter and not less than 10 milliamperes are absolutely necessary when making the exposure. Time of exposure given below is for a patient of medium weight and age.

Exposure with double intensifying screen, ultra-speed or diaphax film ..... 8 seconds.

Accessory Sinuses

For further details of angles employed in radiographing the frontal, maxillary and accessory sinuses, a study of the following chart should be made, bearing in mind that the intensifying screen is used for such exposures, the time required being approximately 10 to 12 seconds, varying slightly with the age and weight of the patient.

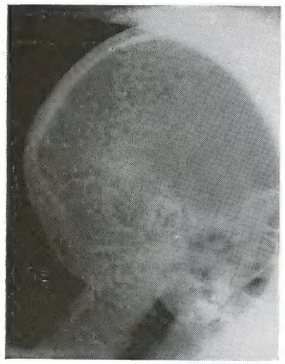


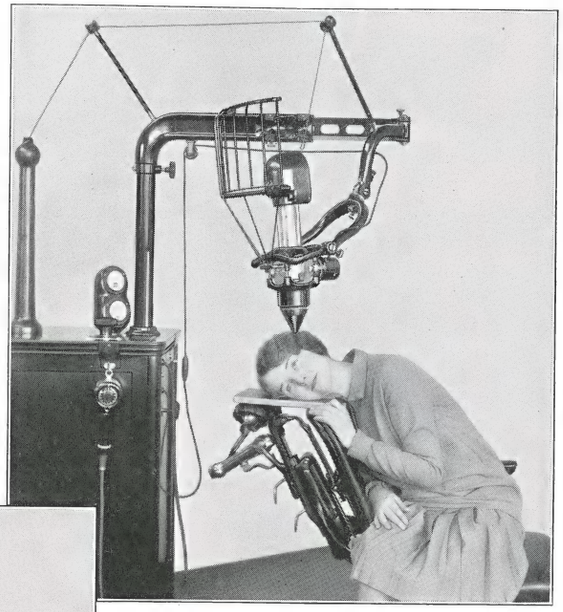
Courtesy University of California

Figure 58

Illustrating Correct Angle for Frontal, Maxillary and Accessory Sinus Examination

1-5 Plane of plate 1/C 23° of angulatien of head.
G-H Direction of principal rays for frontal sinus.
A-B Direction of principal rays for frontal ethmoid and antrum.
3-4 Plane of plate 1/C 23° angulation for all sinuses.
1-2 Plane of plate for Superio-inferior of ethmoid sinus.
D-C Direction of principal rays for Superio-inferior of sphenoid.
6-7 Plane of plate 1/C 23° angulation for inferio-superior of sphenoid sinus.
3-F Direction of principal rays for inferio-superior of sphenoid sinus.





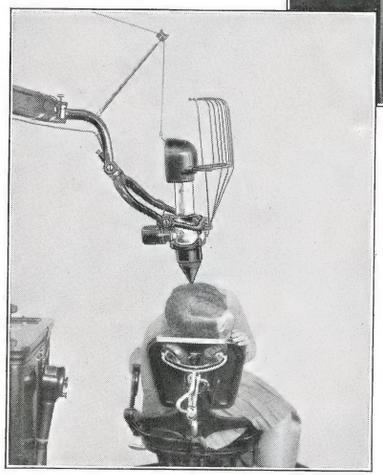


Figure 59

Mastoid Examination

For this radiograph the headrest and backrest of the Chair form a support for the film or cassette, in a horizontal position upon which the patient lays the head, as shown in Figure 59, keeping the sagittal plane parallel with the film, with the affected ear next to the film and the pinna folded under.

The point of the cone should just touch the patient, with the central ray entering the head above and behind the external auditory canal and emerging at the external auditory meatus next to the plate. An angle of about 10 degrees toward the face and 10 degrees toward the feet will, in the majority of cases be correct.

Exposure without screen..... 7 seconds
Exposure with screen.. 3 seconds

Use Eastman ultra-speed or diaphax film.

Profile Radiography

Profile Radiography is a technique for taking X-Ray pictures that shows the soft tissue of the face outlining in detail the profile of the patient (Fig. 60). It can be used to an advantage in orthodontic and prosthodontic work. The orthodontist can use it to determine the thickness of the tissue over the bone and the relation between the occlusal plane and the lips. It provides a preliminary plan that enables the operator to determine the procedure that will be most effective in handling the case.

The profile picture can be cut along the line of the tissue which will give both a detailed profile picture and a templet of the facial outline before the work is started (Figs. 61 and 62). A corrected profile may be made from it by taking into consideration the tissue movement that will result from changing the position of the teeth and drawing the corrected profile on cardboard. It may be cut out and used to check the progress of the work.

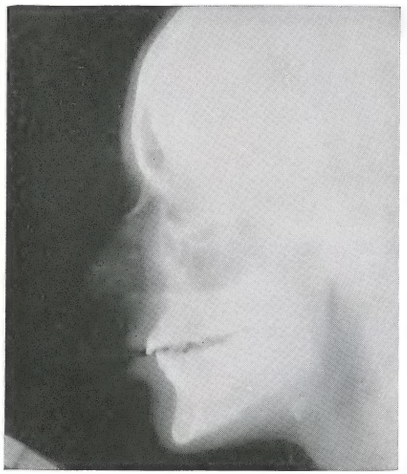


Figure 60

The profile Radiograph showing a definite outline of the soft tissue

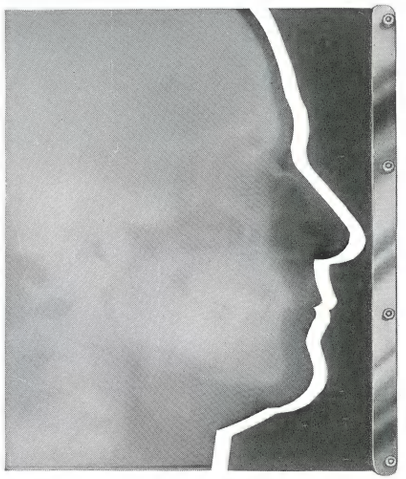


Figure 61

The profile cutout providing a profile picture for an orthodontia or prothodontia survey and a templet for checking the progress of the work

The orthodontist may take profile pictures from time to time during the progress of the work which will give him a definite record of what has been accomplished.

Profile Radiography is usually used in prosthetic work to reproduce the original profile, though it may also be used to improve the profile in the same manner in which it is done in orthodontia.

Usually, when patients reach the age when they require artificial teeth, it is their desire to retain their natural facial outline.

The profile picture should be taken prior to extracting the last few teeth. The idea is to get an outline of the original profile. The picture may be taken

many years before the final extraction, if possible to do so. The cut-out portion of the film may be used in taking the bite to make sure that the lower jaw is in the position it would be if the teeth were in the mouth and in normal occlusion.

The templet may also be used in fitting the trial denture which may be built out to reproduce the original contour of the tissue. Profile radiography is the simplest and most accurate of the many methods that are employed for this purpose.

Figure 62

Reproducing the features with the aid of the X-Ray templet. The templet can be used to a very great advantage in taking the bite and fitting the trial denture

Profile Radiographic Technique

The technique for taking profile radiographs, while somewhat different from that of other work, is not at all difficult with the Ritter Machine. The calibrated angles permit an accuracy of adjustment that enables the operator to get very good results with very little effort.

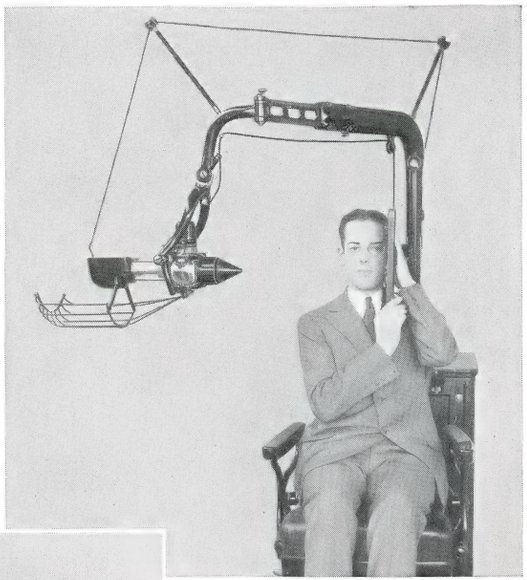
The film-holder is placed in a position against the cheek parallel to the median plane. The head and film-holder should be supported in such a manner that there will be no movement during the exposure. The tube is set at zero and placed at a film target distance of at least three feet. A longer film target distance of from five to seven feet will produce a more accurate profile picture but conditions in the average operating room do not permit an extremely long film target distance and three feet is found to be accurate enough for the purpose of reproducing the features of the subject both for orthodontic and prosthetic cases.

The tube should be positioned at right angles to film and so that the cone pointer is directed at the corner of the mouth. This position can best be obtained by placing your eye parallel to the long axis of the tube and sighting it so that a projection of this line will pass through the patient's lips. (The upper and center pictures on the next page illustrate this position.)

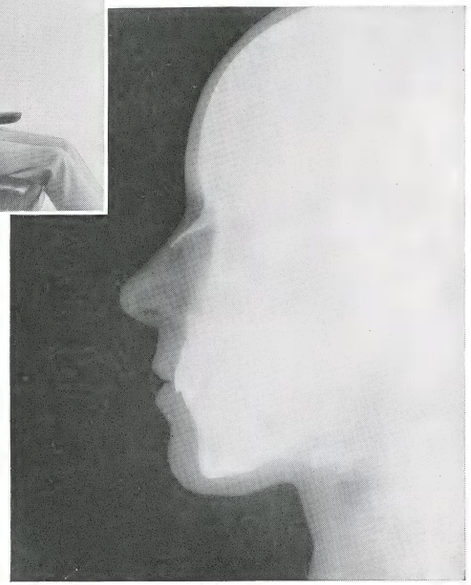
With an Eastman ultra-speed or diaphax film, it is suggested that an exposure of one-half second be given when intensifying screens are used and one and one-half seconds when the picture is taken without screens. The films are developed the usual length of time. These exposures must necessarily be reduced slightly for small heads and increased for larger ones. For longer film target distances, the exposure can be determined by calculating the square of the distance and increasing exposure accordingly. The exposure increases directly with the film target distance. The square of a three foot film target distance would be nine, the square of a six foot film target distance would be thirty-six. If the exposure for a three foot film target distance is three seconds, the exposure for a six foot film target distance would be four times as long, or twelve seconds.

Film	Target Film Distance	Patient Classification **Exposure Without Screens**			Patient Classification **Exposure With Double Screens**			Developing Time at 65°
		Small	Medium	Large	Small	Medium	Large	
Eastman Super-Speed	36 in.	1	1½	2	¼	½	¾	5 min.

Ordinarily, an X-Ray picture of the face showing tissue detail does not show very much bone detail. Operators who wish to obtain both will proceed as follows: Place two films in the holder and use an exposure of six seconds with screens or nine seconds without screens. Then develop one film for one minute and the other film for the normal length of time, or five minutes. This will give one film with tissue detail and the other film with bone detail. The film showing bone detail may be cut out along the line of the bone and superimposed over the other film. This will give a composite picture showing both bone and tissue detail as illustrated in Fig. 63.



The illustration above and to the left shows the tube, patient and film positions for taking profile radiographs. The cut below illustrates the resultant radiograph.



Film	Target Film Distance	Patient Classification **Exposure With Screens**			Developing Time at 65°
		Small	Medium	Large	
2 Eastman Duplitized Ultra-speed or Diaphax	36 in.	6	7	8	One film 5 min. One Film 1 min.

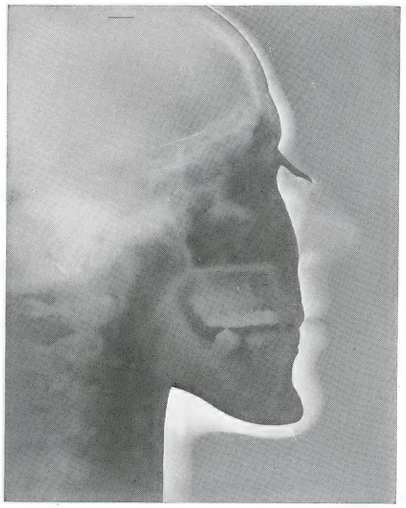


Figure 63

A composite profile picture showing both bone and tissue detail

The film showing tissue detail should be cut out along the line of the profile. The cut out portion should be tried against the face before proceeding with the restorative work in the mouth to make sure that an accurate profile has been obtained. It is considered good practice to place the date and other important information on all films for future reference.

Most profile pictures will be filed for many years. It is therefore advisable to use extreme care in fixing and washing the films. They should be fixed for at least ten minutes and washed in running water for not less than fifteen minutes. This will prevent discoloration after the films have been on record for a long period of time.

X-Ray Dosage

It has been suggested that operators never exceed one-half the erythema dose or 600 milliampere seconds, and the exposures we have recommended are well within this limit.

By passing the rays through a filter of aluminum, 1 millimeter in thickness, the allowable dose may be increased about 40 per cent.

The dose necessary to produce erythema, causing a slight temporary redness of the skin, is 1200 milliampere seconds, at a target skin distance of 8 inches. At 16 inches this would be 4800 milliampere seconds. Milliampere seconds is a term used for the product obtained by multiplying the milliamperes shown on the milliampere meter by the time of exposure in seconds.

Extremity Radiographs

These radiographs can be made with the tube operating at its normal voltage and current of 10 milliamperes, using Eastman ultra-speed or diaphax films, with the exposures given.

The films should be loaded into cardboard holders or a cassette as explained under heading of Extra-Oral Radiographs.

A simple rule to be observed is the direction of the ray in relation to the film. This should be perpendicular to the plane of the film to prevent anatomical distortion.

The distance of the tube governs the size area to be exposed and this should be measured from the target of the tube to the surface of the film. By referring to the diagram on page 73 this can be readily determined.

The dental chair offers an excellent means of positioning the patient as it is possible to raise and lower the chair as well as the tube-stand of the machine.

In the majority of cases, this permits the point of the cone or the center ray to be positioned accurately in the center of the object and film, first, after which it can be raised to the proper height without disturbing the focus.

It is advisable to remove all clothing or as much as possible when radiographing various parts of the anatomy so as to exclude such shadows from interfering with the diagnostic qualities of the radiograph.

The time of exposure can be determined for various parts of the anatomy, at specified distances, by using the time given on the following pages, or by referring to the chart on page 72.

Where fractures have been set in metal splints or plaster casts it is advisable to add one or two seconds to the time of exposure which is charted. This depends entirely on the thickness of material used in the construction of the splint.

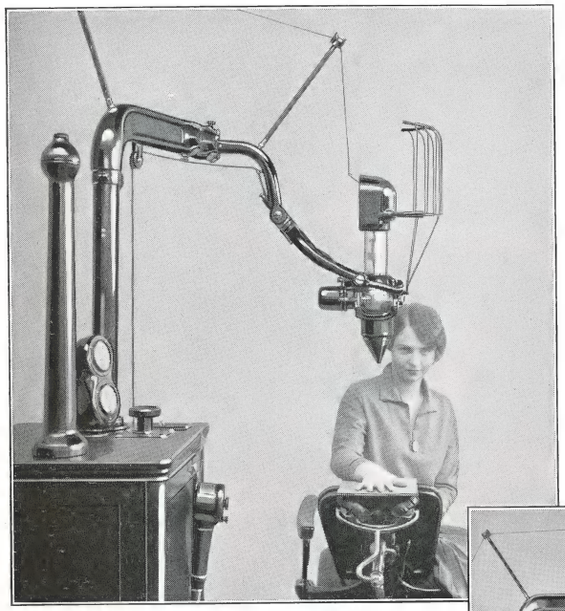
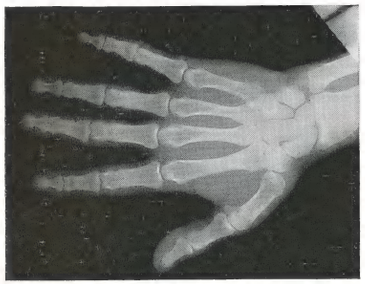
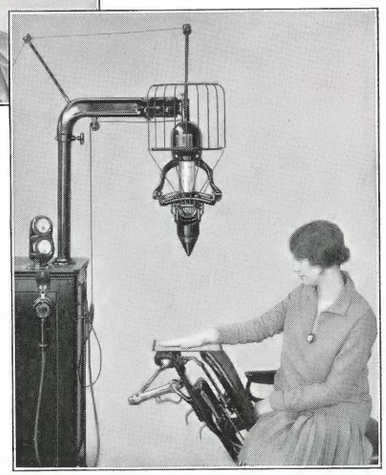


Figure 64





HAND { Carpals / Metacarpals

Target film distance	24 inches
Milliamperes	10
Without intensifying screen	1½ seconds

Use 5 x 7 or 8 x 10 duplitized ultra-speed or diaphax film.

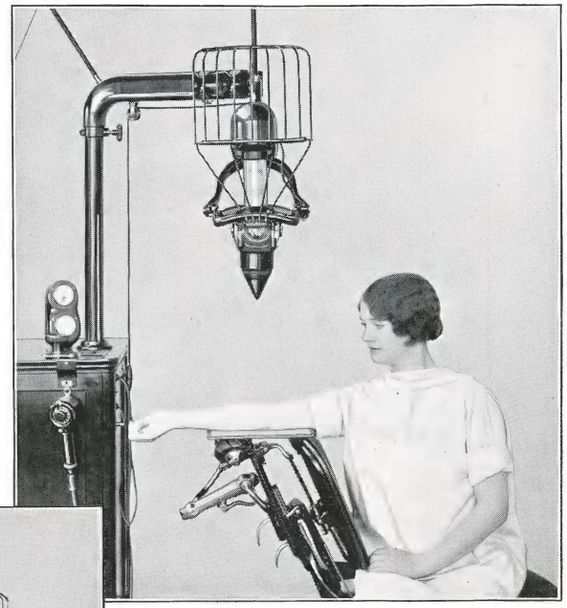
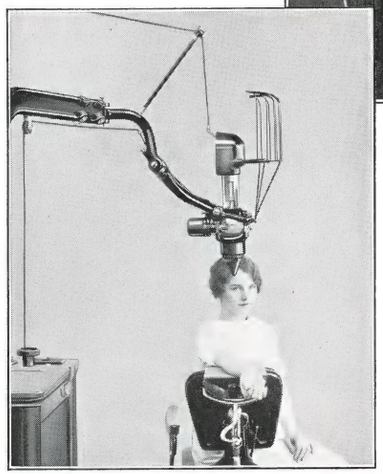
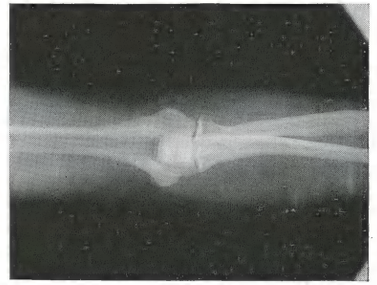


Figure 65





ELBOW (Antero-Posterior)

Target film distance	24 inches
Milliamperes	10
Exposure without intensifying screen	3 seconds

Use 8 x 10 duplitized ultra-speed or diaphax film.

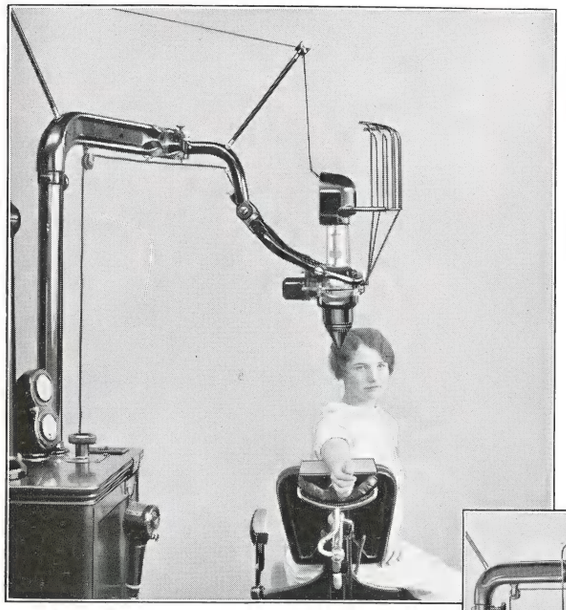
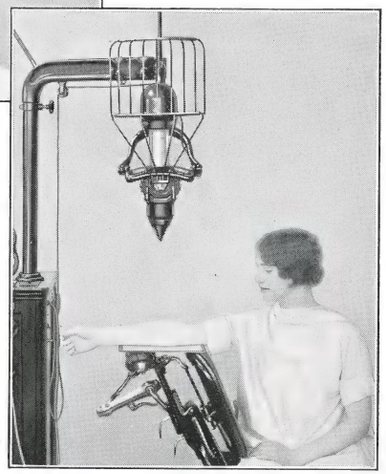


Figure 66



ELBOW (Lateral)

Target film distance	24 inches
Milliamperes	10
Exposure without intensifying screen	3 seconds

Use 8 x 10 duplitized ultra-speed or diaphax film.

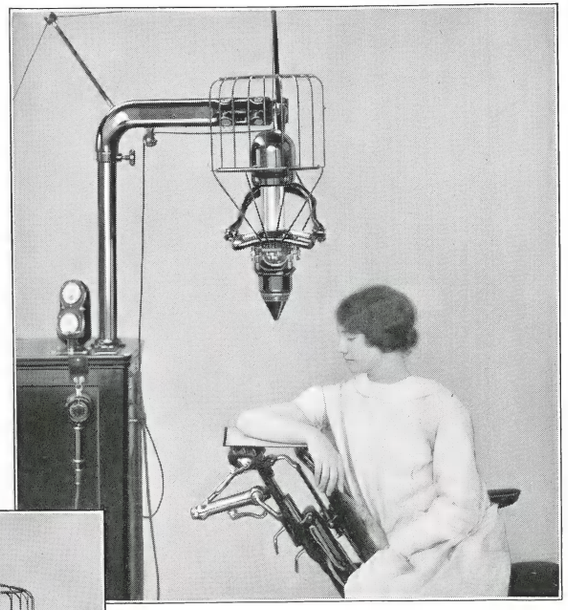
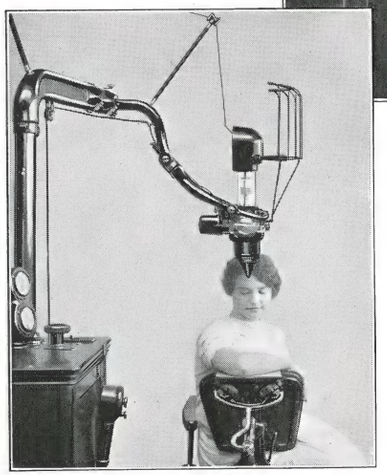
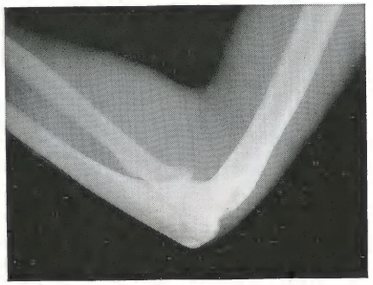


Figure 67

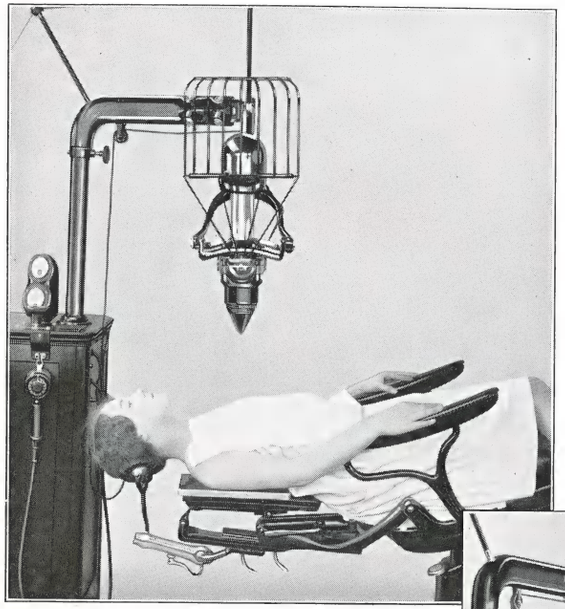




ELBOW

Target film distance	24 inches
Milliamperes	10
Exposure without intensifying screen	3 seconds

Use 8 x 10 duplitized ultra-speed or diaphax film.



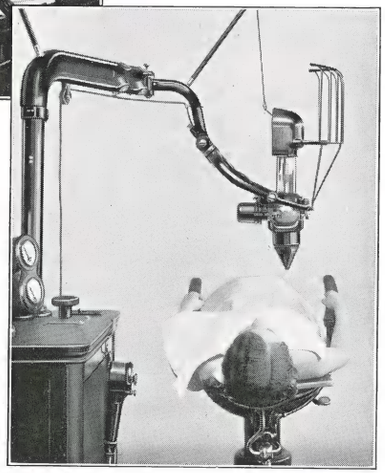
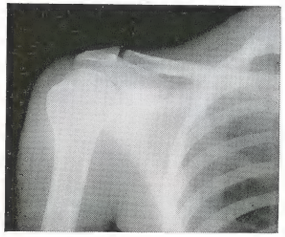


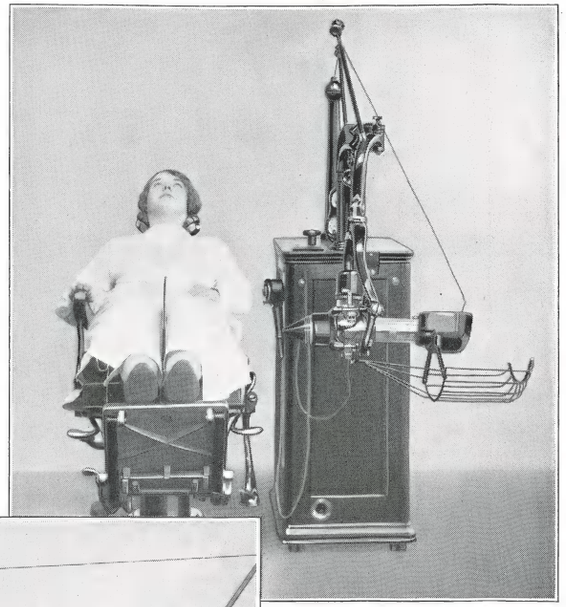
Figure 68



SHOULDER (Antero-Posterior)

Target film distance	24 inches
Milliamperes	10
Exposure with double intensifying screen	5 seconds
Without intensifying screen	10 seconds

Use 8 x 10 or 10 x 12 duplitized ultra-speed or diaphax film.



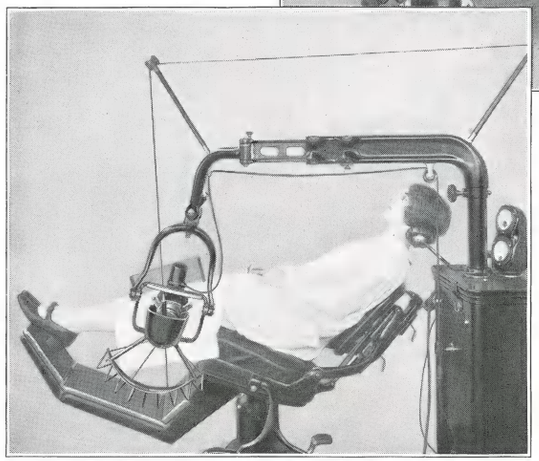
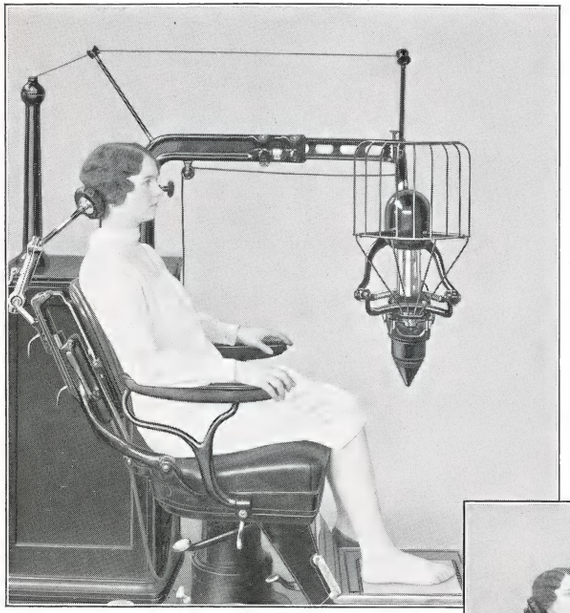


Figure 69

KNEE (Lateral)

Target film distance	24 inches
Milliamperes	10
Exposure with double intensifying screen	3 seconds
Exposure without double intensifying screen	7 seconds

Use 8 x 10 ultra-speed or diaphax film.



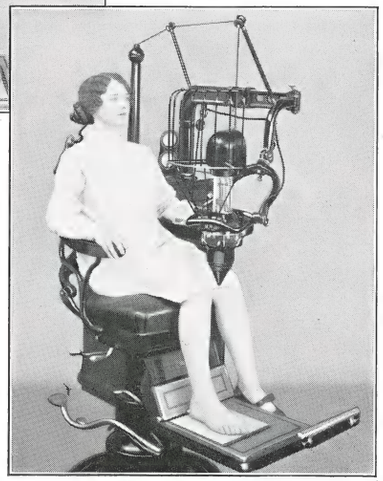
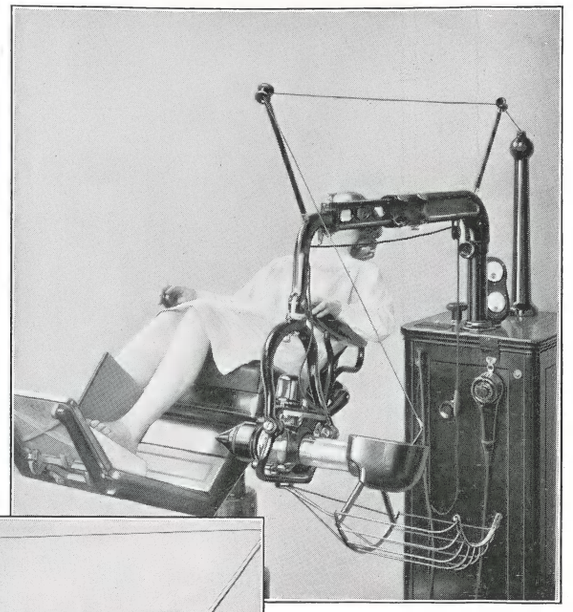


Figure 70

FOOT { Tarsus / Metatarsus

Target film distance ..... 24 inches
Milliamperes 10
Exposure without intensifying screen ..... 1½ seconds

Use 8 x 10 duplitized ultra-speed or diaphax film.



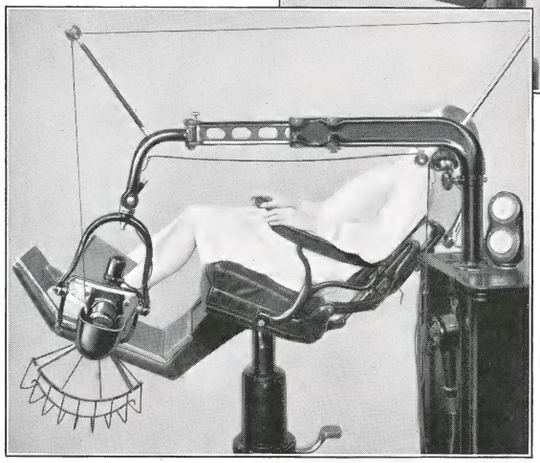


Figure 71

ANKLE (Lateral)

Target film distance ..... 24 inches
Milliamperes 10
Without intensifying screen ..... 4 seconds

Use 8 x 10 or 10 x 12 duplitized ultra-speed or diaphax film.

Radiographic Examination of the Chest

The purpose of this chapter is to give a brief outline of X-ray examination of the chest, especially, for such cases where a tooth may have become lodged in either lung accidentally as the result of a surgical operation. It also is indispensable in an examination of the ribs and to ascertain a definite pathological meaning of certain X-ray appearances, through an inspection of the Thoracic Viscera.

Fluoroscopy may be considered best for the study of diseases of the chest, although a radiograph has the value of remaining a permanent record.

The chest radiograph may be taken preferably with the use of a 14 x 17 Eastman duplitized ultra-speed or diaphax film with approximately 4 seconds for the average adult, using a target film distance of 36 inches.

The ideal would be to make an exposure of the chest in a fraction of a second, owing to movements of the respiratory organs and tissues, but this is not possible with a 3 inch machine, therefore, it is important that the patient be instructed to hold the breath.

The patient should remain in an erect standing position as this will produce the smallest shadow of the heart, while the dome of the diaphragm is then at its lowest position. A prone position should only be used under special circumstances for the purpose of demonstrating shifting of fluids or where the patient is an infant or a very sick adult who cannot be maintained in a standing position.

The favorite position is the Dorsoventral (postero-anterior) shown in Figure 72-A with the tube directed from behind the patient which usually gives all the information desired.

Figure 72-B shows the Ventrodorsal (antero-posterior) position with the tube directed from in front of the patient. In either position the tube is directed with the central ray passing at right angles to the plane of the film. It will also be noted that the arm of the dental chair serves as a support for the cassette, as it is possible to raise and lower the chair suitable to the height of any individual.

Needless to say it requires extensive experience to study chest radiographs, as the bulk of linear markings are made up of blood vessels and therefore it requires one very competent to judge the finer pathological changes which they demonstrate.

Advocating the use of the Ritter X-Ray Machine for the various parts of the anatomy, brings to the operator a type of equipment which will meet all emergencies not only for the Dental Profession, but making it possible to render a service of the highest character to associates of the Medical Profession.

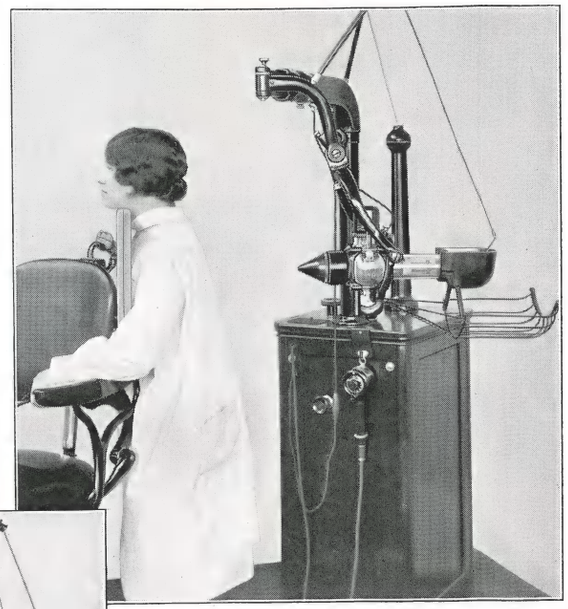
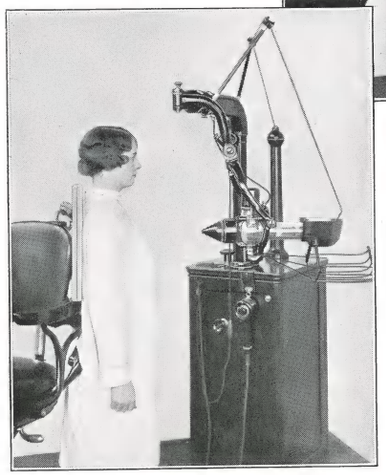


Figure 72-A



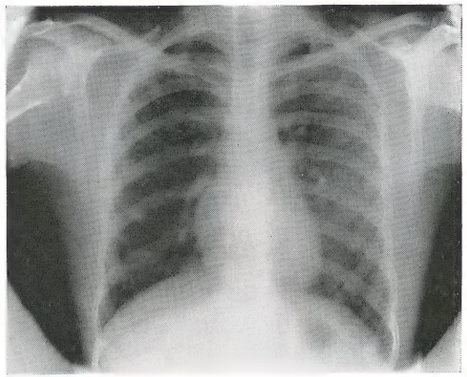


Figure 72-B

CHEST

Postero-anterior. Dorsoventral—

Target film distance	36 inches
Milliamperes	10
Exposure with double intensifying screen	4 seconds

Antero-posterior. Ventrodorsal—

Target film distance	36 inches
Milliamperes	10
Exposure with double intensifying screen	4 seconds

Use Eastman 10 x 12 or 14 x 17 ultra-speed or diaphax film.

This chart shows film target distance and exposures necessary for making

Sinus, Mastoid, Extra-Oral and Extremity Radiographs

with Eastman 8x10 Duplitized Ultra-speed or Diaphax Films

Area	Film Target Distance	With Double Screen Seconds	Without Screen Seconds
Frontal Sinus	Cone in contact with patient.	8	..
Maxillary Sinus	Cone in contact with patient.	8	..
Mastoid	Cone in contact with patient.	3	7
Lateral Jaw	Cone in contact with patient.	1½	6
Cervical Vertebrae.	24″	3	5
Chest	36″ (14 x 17 film)	4	..
Shoulder	24″	5	10
Elbow	24″	..	3
Arm	24″	..	2
Hand	24″	..	1½
Wrist	24″	..	1½
Spine	20″	7	..
Hip	24″	8	..
Knee	24″	3	7
Leg	24″	2	4
Ankle	24″	..	4
Foot—Toes	24″	..	1½

The above exposures are for persons of normal build between ages of twenty and fifty. For thin and young patients, decrease exposure one-fourth. For stout and old patients, increase exposure one-fourth.

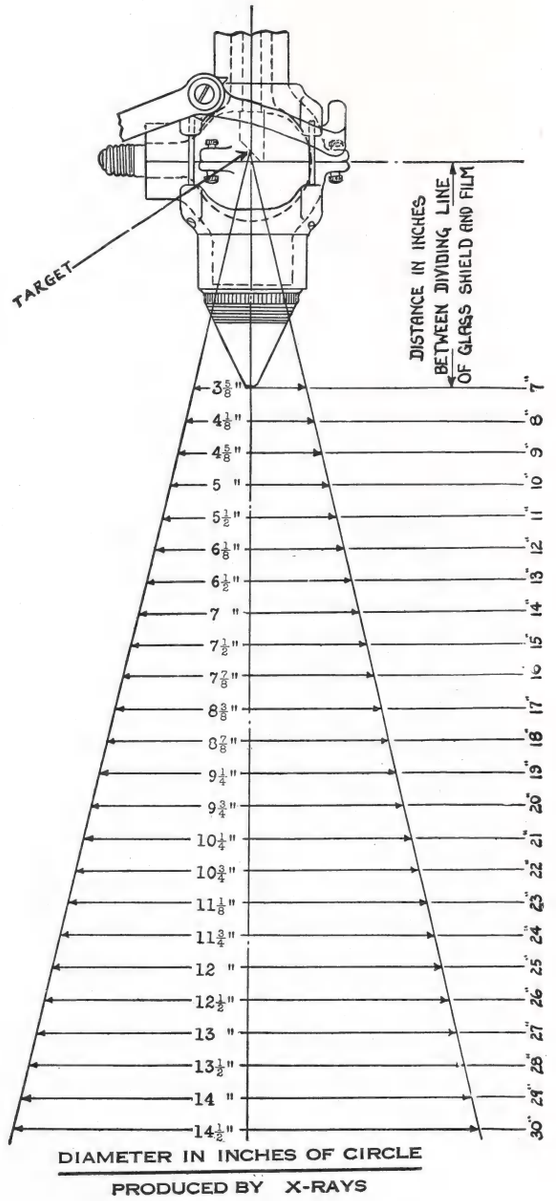


Figure 73

Development of X-Ray Films by the Standard Time Method

Through some inexplicable reason, this very important photographic phase of radiography has been greatly neglected. As a result of this condition, radiographs which have been properly exposed and taken at the proper angle have been spoiled and made useless for diagnostic purposes. Many conscientious operators, who through sheer carelessness or ignorance of darkroom procedure have spoiled radiographs, either unjustly condemn the X-ray machine they are using or else lose faith in their ability to take good radiographs. It is no idle statement that a radiograph can be "made" or "broken" in the darkroom. However, if a few simple rules of darkroom procedure are followed, gratifying results will be obtained in the shape of good radiographs, thus facilitating proper diagnosis.

The development of X-ray films is carried out practically the same as the development of ordinary negatives. Since we are after maximum detail and contrast, special developing solutions must be used for X-ray work.

X-ray films are very sensitive to light, more so than ordinary photographic films. It is therefore, important to have a good dark room and safelight. Cleanliness and careful attention to detail are very important in order to do good radiograph work.

Films need not be developed immediately after exposures have been made, but can be developed several days later, if necessary, provided they are not exposed to X-rays in the meantime.

In opening the packet be careful not to catch the films on the face because finger prints are likely to be impressed in the emulsion; it is better to withdraw them by the edges.

For any X-ray film or plate there is only one time of development that will bring out the maximum amount of quality. If after developing for this standard time the negative is too dense, the film was over-exposed while if the negative is too thin, the film was under-exposed. Some have found that by developing the over-exposed negative for a longer time satisfactory negatives could be obtained. The mass of experimental evidence indicates without any question that these results are never so satisfactory as when the exposure was correct and the development time standard. Moreover, it is far easier to standardize X-ray exposures than to alter development greatly, because using a machine of this type where the voltage and milliamperage are constant, exposures may be duplicated so precisely that with a given development technique the results are uniformly the same. This means that, if desired, development may be left to a darkroom assistant who will be governed by a simple routine, that is, all films will be developed for the same length of time and at the same temperature regardless of their nature. There is but one qualification of this statement. The proper developer must be used. Eastman Prepared X-Ray Developer Powders have been compounded to meet completely these particular requirements. All the materials entering into them are rigidly tested and the compounding is so carefully done that if mixed according to directions they may be relied upon always to give the same developing solution.

The chart shows the relation which exists between the time of development and the temperature of the developer. Although 65 degrees is the optimum temperature, work can be done at other temperatures by correcting the time of development. The method may be stated as follows: The temperature of the developer is taken using a good standard thermometer (the Eastman Tank Thermometer is designed for this purpose) and the necessary developing time is noted on the chart. An automatic timer may be set after immersing the films, and when the signal is given the films are removed with the assurance that they have been properly developed. If the negatives are too dark or too light, it will be a simple matter to correct future exposures accordingly. Thus in a few days the entire exposure and development technique will be reduced to a standard basis.

X-ray developer made by using the prepared powders may be replenished from time to time without appreciably affecting its qualities. If a tank is used about a fifth of the developer should be withdrawn every week or so and a corresponding amount of fresh developer added, thus the solution may be kept without completely discarding for a number of weeks. Once a month, empty the tank, wash it thoroughly and mix up a fresh solution.

After the film has been developed for the proper length of time it should be washed in clear water before putting it in the fixing solution and left until the unaffected silver in the emulsion is dissolved. The tempearture of the fixing solution should be at least as low as the developing, even lower. The negative is left in this solution about ten minutes—during which time it will have cleared. This is noticed by the milky appearance on the negative having disappeared.

After the film has been in the fixer a minute or so, it may be exposed to the white light for examination, as it is no longer sensitive to light. When the negative is thoroughly fixed, it must be washed in clear running water for at least fifteen minutes to be sure that all of the Hypo has been removed. The next step is to dry the negative.

It cannot be too strongly impressed that thorough cleanliness must be adhered to, directions in making solutions carefully followed, and the film carefully handled, never holding it except along the edges by the metal clips for this purpose.

Several noted authorities recommend that the two films in each package, in other words, the two films exposed at the same time, be developed for different lengths of time, one for four minutes and the other for five minutes, which will naturally give one light and one dark radiograph.

These two films should then be placed in a film mount in which the centers of the openings are 2½ inches apart, and viewed by means of a suitable stereoscope.

They explain that in some cases certain pathological conditions will be eliminated by a five-minute development and others will not show up with the four-minute method, and by viewing one film with the right eye and the other with the left eye, the resulting composite picture will show up all of the conditions that may exist at a glance and will also give a stereoscopic effect, which, although not a true stereoscopic picture, is of assistance to the diagnostician.

Usually an ordinary closet can be converted into a suitable dark room by excluding all daylight. Where space is not available for a dark room, an Eastman or American Cabinet developing box may be used very satisfactorily.

Standard Time-Temperature Development Chart

For Eastman Dupli-Tized Ultra-speed, Diaphax and Dental X-Ray Films

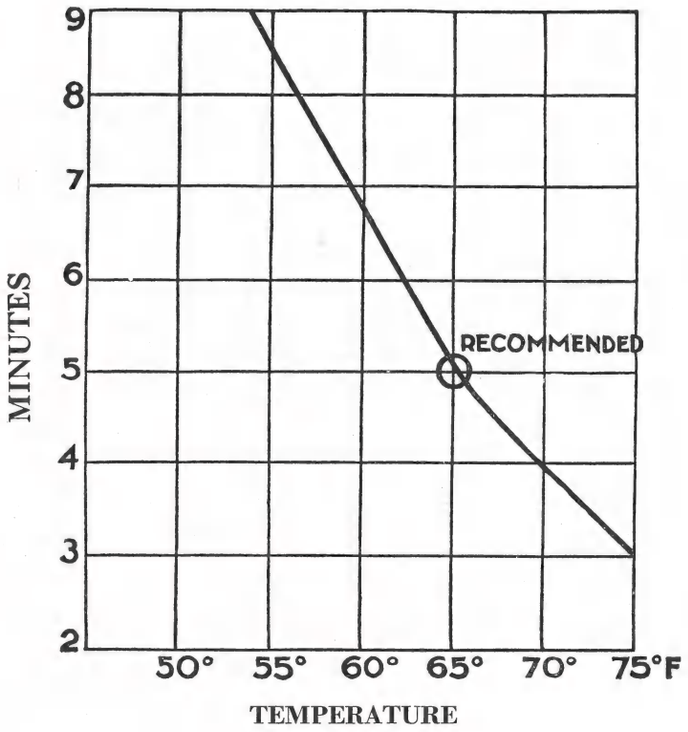
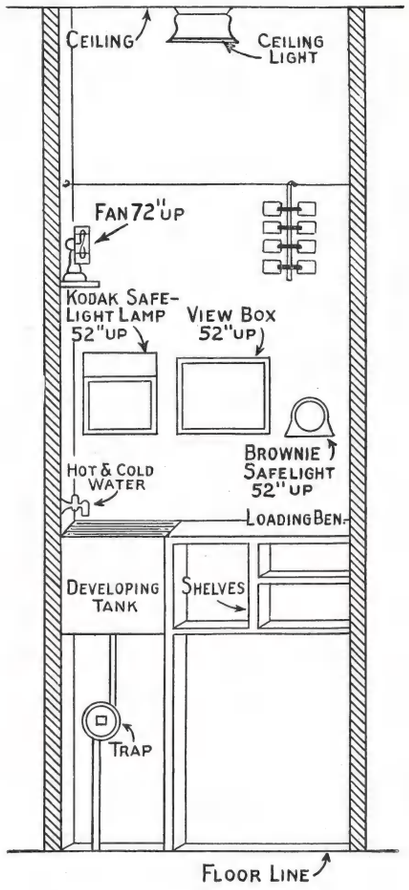


Figure 74

After carefully taking temperature of developer, trace a vertical line on the chart from the temperature line until it intersects the curve, then trace a horizontal line from this point to the left margin. This will indicate the correct time of development for Eastman Dupli-tized X-Ray and Dental Films.



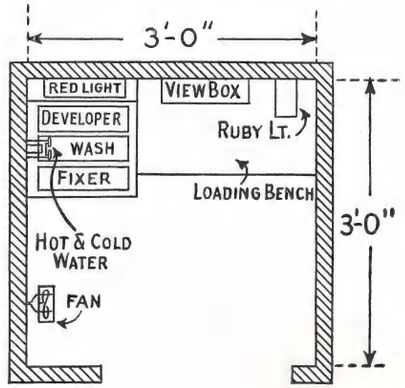


Diagram of Dark Room Arrangement

Dark Room with special tank for solutions and running hot and cold water. Trays for solutions not needed.

The Bench arrangements shown here can be worked into almost any size room but the sizes indicated are used where space is limited.

Special precaution should be taken to exclude all outside light. The room should then be illuminated by proper safelight lamps, never using more than 25 watt bulbs. This will prevent fogging of films.

The Eastman 6-A amber color safe light is recommended for use with all X-ray film.

Dark Room Photographic Accessories for Intra-Oral and Extra-Oral Radiography

"Regular" No. 1, Eastman Dental X-Ray Films, per doz.	$ .70
"Extra Fast" No. 1 Eastman Dental X-Ray Films, per doz.	.70
Eastman No. 2 Occlusal (Bite) Film, Regular, per doz.	2.45
Eastman No. 2 Occlusal (Bite) Film, Extra Fast, per doz.	2.45
Eastman Radiatized Dental Films, pkg. of 2 doz. (2 Film Packet)	1.40
Eastman Radiatized Dental Films, pkg. of 2 doz. (1 Film Packet)	1.15
Eastman Bite Wing Dental Films, Type 1, per doz.	1.25
Eastman Bite Wing Dental Films, Type 2, per doz.	1.50
Eastman Bite Wing Dental Films, Type 3, per doz.	1.75
or	
Regular Brand Buck's X-Ograph No. 1 Dental Films, box of two doz.	1.50
Speed Brand Buck's X-Ograph No. 1 Dental Films, box of two doz.	1.50
Regular Brand Buck's "Molar" Size Films, per doz.	.70
Speed Brand, Buck's "Molar" Size Films, per doz.	.70
1 pkg. Eastman Ultra-speed or Diaphax X-Ray Films, 5 x 7, per doz. duplitized	1.75
1 pkg. Eastman Ultra-speed or Diaphax X-Ray Films, 8 x 10, per doz. duplitized	4.00
2 Eastman X-Ray Exposure Holders, 5 x 7 at	.15
2 Eastman X-Ray Exposure Holders, 8 x 10 at	.20
1 gal. pkg. Eastman X-Ray Developer No. 3	.85
1 gal. pkg. Eastman X-Ray Fixer No. 3	.75
1 pkg. Eastman Film Clips	1.10
1 Eastman 8 x 10 Double Intensifying Screen mounted in cassette	30.00
1 Eastman 8 x 10 Developing Tank	25.00
1 Eastman Tank Thermometer	.75
1 Eastman Brownie Safelight Lamp	1.00
1 Eastman Kodak Safelight Lamp, Series No. 2	3.50
1 Box Wood Block Film Holders	.25
1 Eastman Kodak Dental Film Safe	3.00

Above prices are subject to change. We do not manufacture or supply X-ray accessories. Purchase direct from your Dental Dealer.

How to Determine when Radiographs are Right or Left

Intra-Oral radiographs may be readily distinguished as to whether they are right or left by observing them as follows: Viewing the film with the shiny side toward the observer gives a lingual aspect, or in other words the observer may imagine himself sitting inside the patient's mouth and looking out and whatever is the observer's right is also the patient's right.

For example, if viewing the upper molar teeth, with the apices pointing up and the shiny side of the film toward the observer, if the distal of this region (which in this case is the third molar) appears to the right, then it is the upper right molar region. If the distal appears to the left, then it is the upper left molar region.

The Eastman Radiatized film has two dull sides. The raised point on this film represents the dull or tube side. The depression represents the shiny side.

Electric Current Suitable for Operating the Ritter X-Ray Machine

The Ritter X-Ray Machine has been designed so that it can be operated on either Direct or Alternating Current with but a simple change in the connections when changing from one current to the other.

In order to adapt the machine for use on the various voltages and frequencies, we have provided two separate groups of transformers—one group being suitable for frequencies from 25 cycles to 39 cycles, inclusive—the other group from 40 cycles to 140 cycles, inclusive. These transformers are constructed so they are suitable for operation on voltages ranging from 58 to 73 inclusive, and from 105 to 120 inclusive, and when the supply current, either Direct or Alternating, exceeds 140 volts, a special adapter must be used for reducing the voltage. This we can supply. These adapters are made for voltages up to and including 250 volts and any frequency.

As explained in above paragraph it will be understood that our high voltage transformers are designed for a primary voltage of 120 maximum, but by means of the "Voltage regulator" in our machine, the primary or supply voltage can be raised or lowered 20 volts, making it possible to operate on a voltage as high as 140 or as low as 100. Higher voltage than 140 will require an adapter. These adapters or reducers are not a part of the machine, but are in a separate box, and should be located on the wall within reach of the 3-wire cable supplied with the X-ray machine (see Figures 7 and 11)—Operators Manual.

When the current supply is alternating, the machine may be connected direct on the mains provided the voltage and frequency are correct as above explained.

When the supply current is direct, then the machine must be operated through a Rotary Converter, which will be shipped with the equipment if it is properly ordered. On direct current an adapter is also necessary, if the voltage of the supply current is over 140 volts.

The circuit leading to the machine should be fused with 15 ampere fuses, and the size wire should not be less than No. 10B and S gauge, and if the distance from the panel board to the machine is over 60 feet, No. 8 wire should be used.

Information Regarding Tubes Containing Gas, Making Them Inoperable

THE MANUFACTURERS STATE AS FOLLOWS:

Whenever a tube shows a pink florescence through the bulb, it is a sign that it has a slow leak. These leaks are so small that it is impossible to detect them except through this pink coloring. All tubes having slow leaks should be returned to the factory for repairs, as they cannot be overcome by operation.

It is not at all uncommon for Coolidge Tubes to produce a ticking or cracking sound somewhat on the order of the ticking of a telegraph instrument. This is what we call McCall "spitting," and is perfectly harmless, and no tube should ever be returned on this account.

Sometimes this ticking sound disappears after the tube has been used, but if the sound should persist indefinitely it will not affect the efficiency or durability of the tube in any way.

The green florescence in the anode neck of the tube should cause no alarm, as this is characteristic of practically every Coolidge Tube.

A green florescence in the cathode neck of the tube indicates that there is enough gas in it to make it erratic. Re-exhausting at the factory is the only remedy. If there is a green florescence in the bulb but none in the cathode neck, the chances are that this small amount of gas can be absorbed by running the tube at a low milliamperage until the anode becomes heated thoroughly. Once in a while a tube is sent in with a report that it will not hold the milliamperage. This drop in milliamperage is due to gas. The presence of gas may be the result of abuse often due to carelessness on the part of either the demonstrator or the operator. By this we mean that the tube has been run too long at one exposure and the body of the anode is heated so hot that heat generated in it has caused gas to be driven out of the copper. In other words, heat has been generated within the tube faster than the radiator could take care of it. Sometimes this condition is brought about due to an excessive amount of current being wilfully passed through the tube, by the operator employing more milliamperage than the tube is supposed to carry.

It is very seldom that a single small overdose of milliamperage does any particular harm to the tube. It is the multiplicity of these current surges which causes the trouble. Inasmuch as the central station is supposed to carry a fairly even voltage, and practically all X-ray apparatus is designed to operate on such voltage, those who are at all familiar with the X-ray art will doubtless see the reasonableness of the stand we have taken under such circumstances, by declining in some instances to render gratis service for putting the tube back in operable order.

Further examination of the tube might reveal that part of the bulb was discolored, and the doctor's first impression would be that a used tube had been sold to him. In such instances it should be kept in mind that in exhausting this tube it was necessary for it to be on the vacuum pump for approximately four hours, and that for a considerable portion of these four hours X-rays were being produced. This sometimes causes a discoloration in the glass bulb, but will in no way affect its satisfactory operation.

If when the current is turned on, a continuous spark passes between the cathode and the anode, it is indicative of a puncture. Such a puncture is evidenced by a small hole in the glass, and is generally caused by metal coming in contact with the tube while in operation, by a blow, by a high-tension spark jumping to the tube, or by dust, dirt, or moisture accumulating on the tube.

Sparking between the high-tension post on the top of large transformer and the steel transformer case also usually indicates a gassy tube or a break in the high-voltage circuit. If this takes place the fuses also usually blow out.

Dust should not be allowed to accumulate on the tubes, for in time this may become a conductor of electricity.

IMPORTANT

Milliampere stabilizers on X-ray machines control the flow of current (milliamperes) only, and have no influence on the voltage of the supply current at all, in fact there may be quite a perceptible change in this without the operator's knowledge, resulting in a loss of penetration.

The importance of maintaining *proper voltage* may be explained best by stating that the intensity or penetration of X-rays increases with the *first power* of the milliamperage and with the *square* of the voltage. In other words, this means that a change in voltage affects the results in a much greater proportion than a similar change in milliamperage, and consequently it is more essential to keep the voltage constant than it is to keep current constant.

For these reasons, we have not alone equipped the Ritter X-Ray Machine with regulating device for controlling the milliamperage, but we have also provided it with a means for controlling the voltage, the more important factor in the electrical adjustment of any X-ray machine.

Books on Radiography

Name	*Author*	*Publisher*	*Price*
1. Clinical Preventive Dentistry	Raper	Ritter Dental Mfg. Co., Inc.	$3.50
2. Dental and Oral Radiography	McCoy	C. V. Mosby Co., St. Louis, Mo.	2.75
3. Development of X-Ray Films and Plates	Wendell	C. V. Mosby Co., St. Louis, Mo.	2.00
4. Electro-Radiographic Diagnosis	Raper	C. V. Mosby Co., St. Louis, Mo.	3.50
5. Elementary and Dental Radiography	Raper	Items of Interest Publishing Co., 2921 Atlantic Ave., Brooklyn, N. Y.	7.00
6. Interpretation of Dental Radiographs	A. L. Greenfield, D.D.S.	Ritter Dental Mfg. Co., Inc.	2.50
7. Interpretation of Dental Maxillary Radiograms	Ivy	C. V. Mosby Co.	4.00
8. Oral Roentgenology	Kurt H. Thoma	Thoma Dental Publications, 22 Seymour St., Roslindale 31, Mass.	4.00
9. Pamphlet entitled "X-Rays in Medicine"	Eastman Kodak Co.	Mailed free upon request—Eastman Kodak Co., Rochester, N. Y.	
10. Principles and Practice of Roentgenology Technic, I.	Seth Hirsch, M.D.	American X-Ray Publishing Co., New York City	10.00
11. Teeth and Jaws, Annals of Roentgenology	Herman A. Osgood, M.D.	Paul B. Hoeber, Inc., New York, N. Y.	
12. Dental Roentgenology	Leroy M. Ennis, D.D.S.	Lea and Febiger Philadelphia, Pa.	6.50

The above books are recommended as containing authoritative information on Radiography. We do not publish or deal in any of them, except "Clinical Preventive Dentistry" by Raper and "Interpretation of Dental Radiographs" by Greenfield. Please order from your dealer or direct from publishers.

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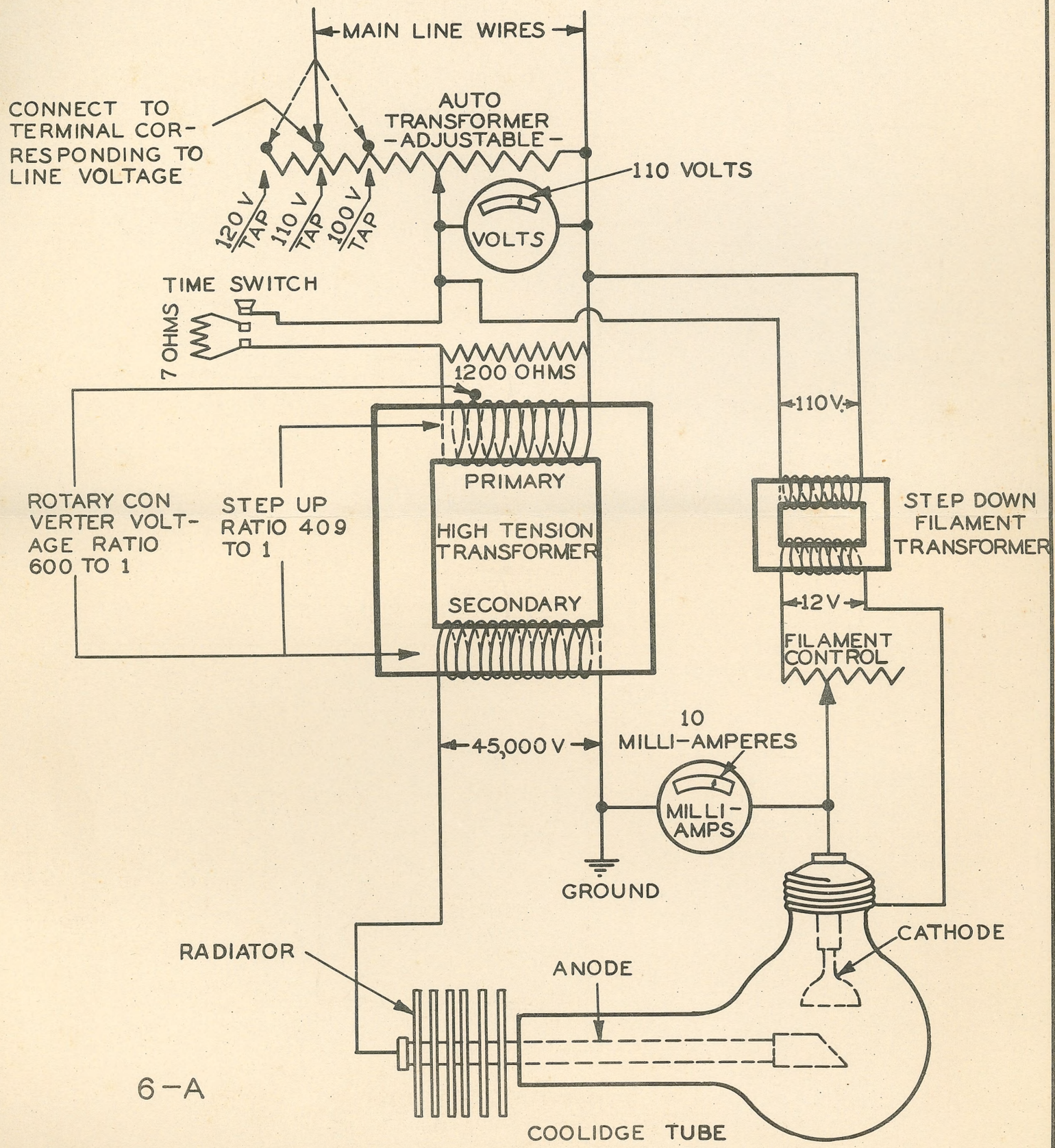
STUDENTS DIAGRAM

SIMPLIFIED WIRING DIAGRAM
RITTER X-RAY MACHINE



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